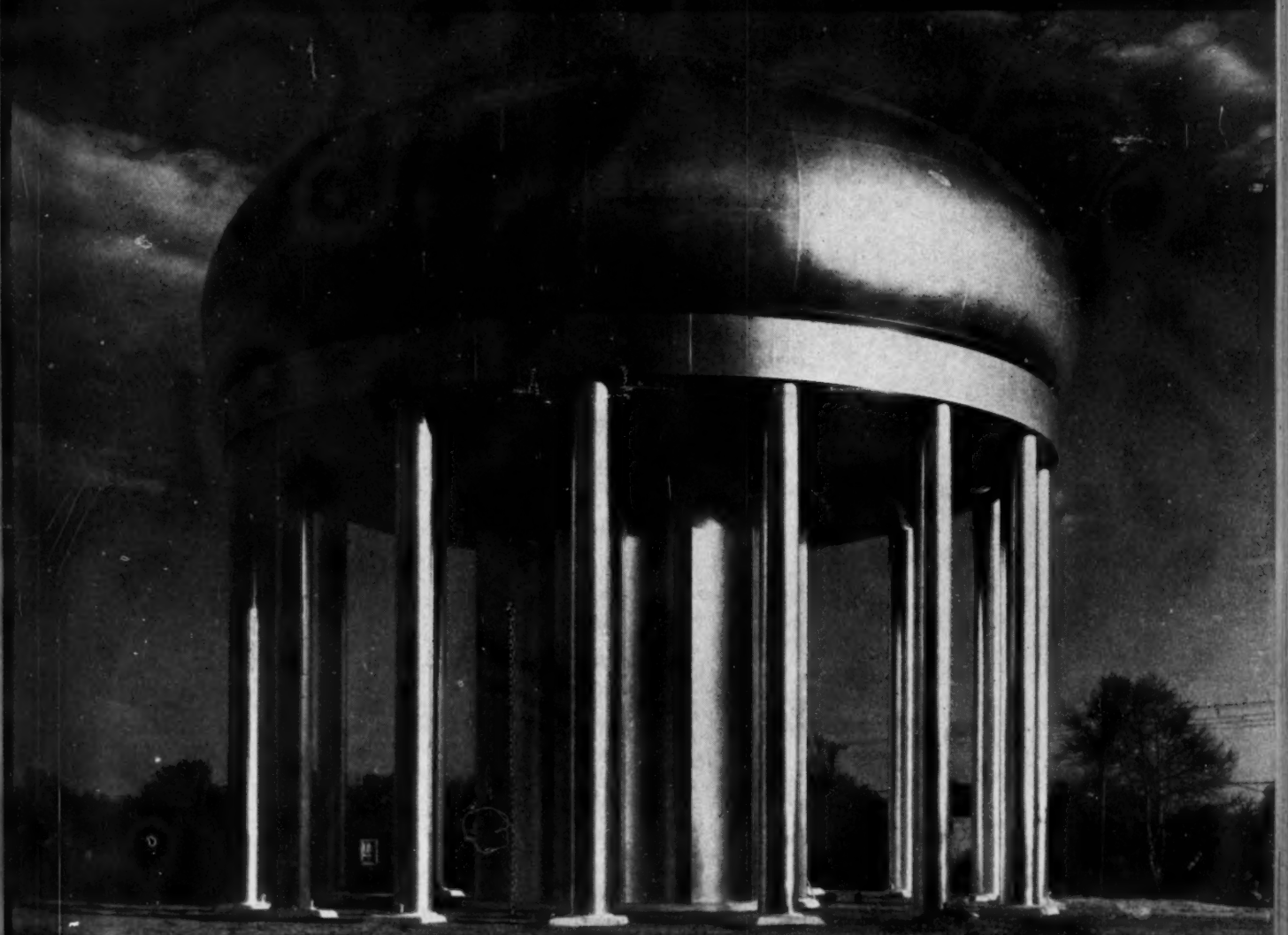
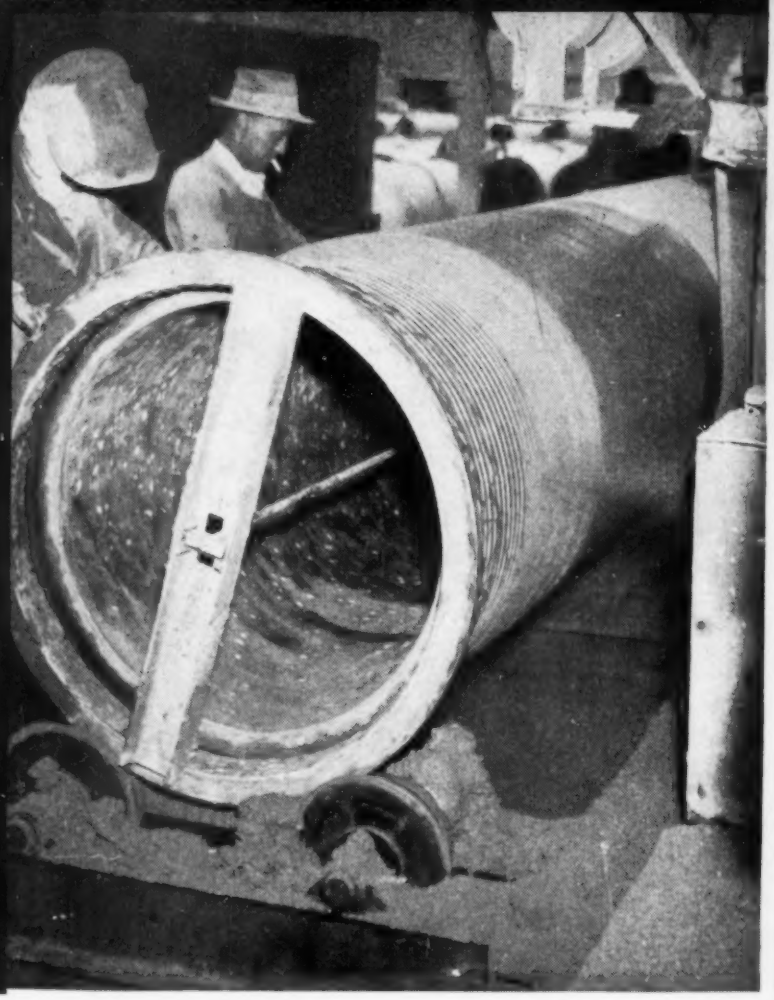
WATER & SEWAGE WORKS



— TANK OF THE YEAR —
Washington's 2,000,000 gal. Spheroidal Tank With Fluted Central Column

ADVANTAGES OF PRESTRESSED CONCRETE CYLINDER PIPE • NO. 4

Maximum use of local labor and materials...



• The installation of Prestressed Concrete Cylinder Pipe offers no exception to the Lock Joint Pipe Company's general practice of setting up temporary manufacturing plants near the location of projects—and using a maximum of local labor and local materials.

All necessary equipment for the manufacture of this high head pipe is transported to the temporary plant where the cylinder is fabricated, tested and lined with a substantial thickness of concrete. After a proper curing period, the lined cylinder is tension wrapped with high tensile wire and protected from corrosion by a mortar coating.

Experience on major installations in various parts of the country has proven that Lock Joint Prestressed Concrete Cylinder Pipe offers many important advantages — higher pressures in a greater range of sizes, increased elasticity, minimum weight, excellent performance and maximum water-tightness. You can profit by this experience if you consult us on all your pipeline problems.

A Hazen-Williams Hydraulic Slide Rule will gladly be sent upon request with our compliments.

LOCK JOINT
Reinforced Concrete
PRESSURE PIPE

LOCK JOINT PIPE COMPANY
Established 1905
P. O. BOX 269, EAST ORANGE, NEW JERSEY
Denver, Colo. · Chicago, Ill. · Kenilworth, N. J. · Kansas City, Mo. · Rock Island, Ill.
Joplin, Mo. · Valley Park, Mo. · Cleveland, Ohio · Hartford, Conn. · Navarre, Ohio

SCOPE OF SERVICES *Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains in a wide range of diameters as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous lines.*

WATER AND SEWAGE WORKS, January, 1947. Volume 94, Number 1. Section 1 (*Section 2 is the accompanying Index*). Published monthly by Gillette Publishing Co., 22 West Maple St., Chicago 10, Ill. Per copy, 25c. Subscription rate, United States, $2.00 per year; Canada, $2.00 per year; Foreign, $3.00 per year. Entered as Second Class Matter, March 12, 1946, at the Post Office at Chicago, Ill., under act of March 3, 1879.

SOLVED

TOUGH SEWAGE PROBLEM

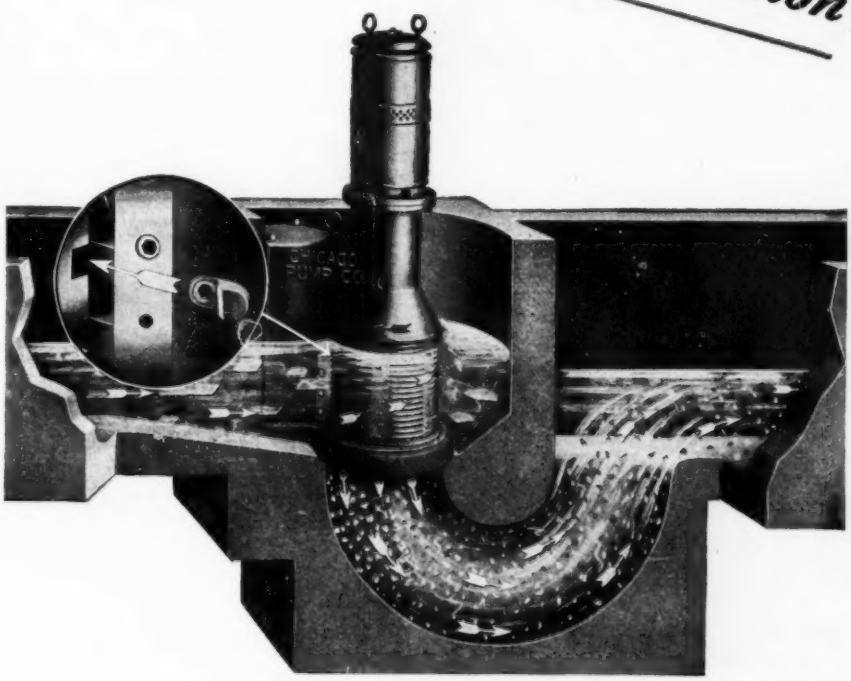
SCREENINGS HANDLING AND DISPOSAL

.....through intensive engineering application

PROVED BY TEN YEARS SERVICE

Comminutors eliminate screenings handling and disposal, the worst nuisance in sewage treatment, by automatically screening and cutting sewage solids under water. No raking of screens and hauling, burial, incineration, or feeding screenings to a grinding mechanism. Eliminate health menace from handling screenings.

Comminutors are easily adapted to existing plants. Over 1,200 installed. Ask for Bulletin 185.

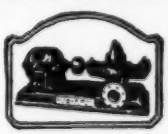


Comminutor installed in a basin forming part of the raw sewage channel. Sewage solids are sheared by cutters on the revolving drum. The small particles pass through the drum slots with the sewage liquor, out the open bottom and back into the downstream channel discharging into the primary tank, where they settle and are pumped to the digester.

CHICAGO PUMP COMPANY

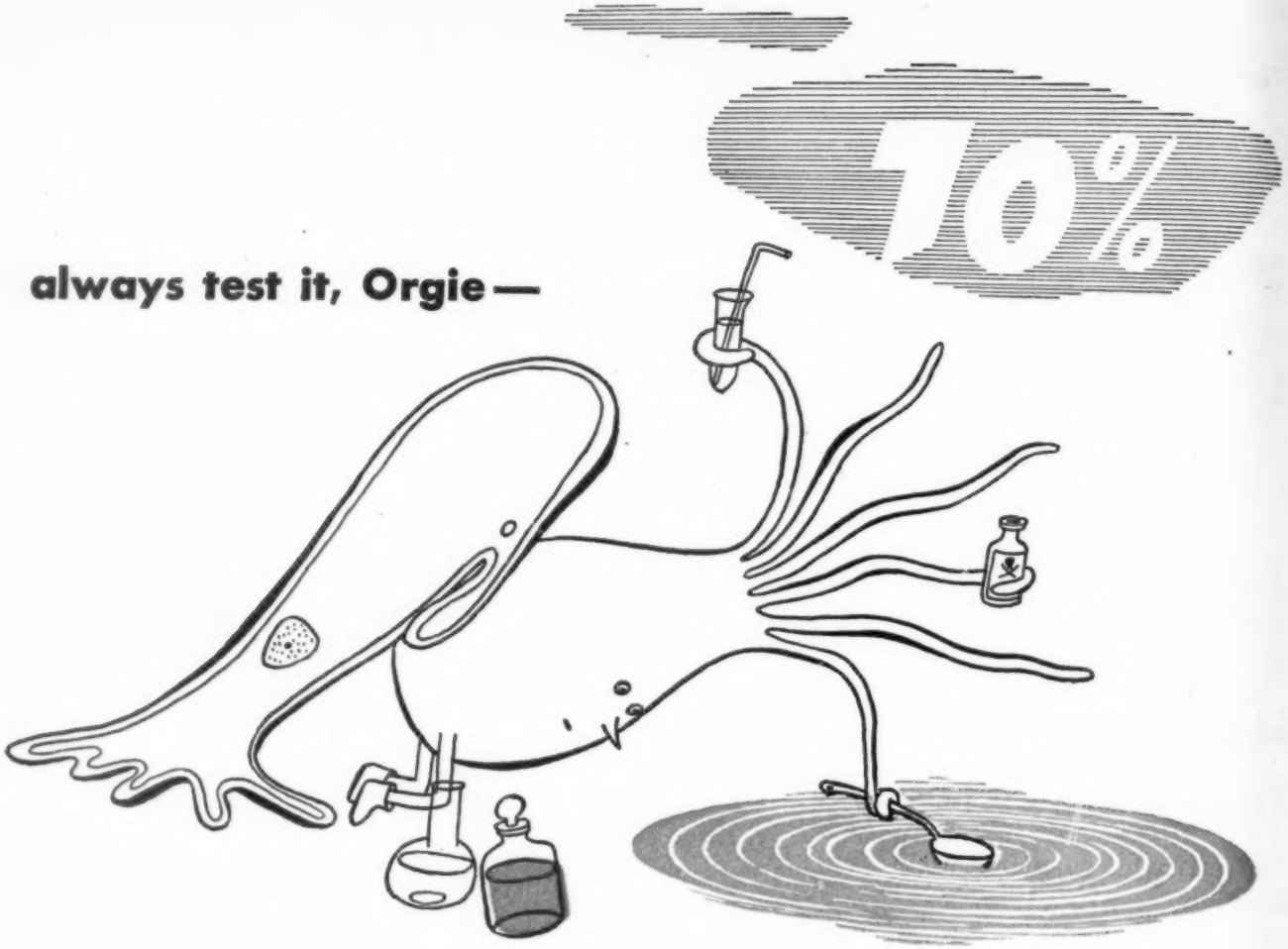
SEWAGE EQUIPMENT DIVISION

2349 WOLFRAM STREET — **CHICAGO 18, ILLINOIS**



Flush-Kleen, Scru-Peller, Plunger, Horizontal and Vertical Non-Clogs, Water Seal Pumping Units, Samplers.

Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.



it might be treated with

PITTCHLOR*

. . . Pittchlor is sure death to chlorine-susceptible microorganisms, bacteria and algae, in water supplies, in sewage, or wherever the germicidal and deodorizing action of chlorine is needed.

Pittchlor is a high-test calcium hypochlorite, with a minimum of 70% available chlorine. Dry, white, and free-flowing, this granular material is easy to handle and apply—either manually or by mechanical feeders.

Stocked by leading jobbers in 5 lb. resealable cans (9 per case), 33¼ lb. cans (12 per case) and 100 lb. drums. Write for descriptive literature covering the uses in which you are interested.

*Reg. U. S. Pat. Office

COLUMBIA ESSENTIAL INDUSTRIAL CHEMICALS

Soda Ash · Caustic Soda · Liquid Chlorine · Sodium Bicarbonate · Pittchlor (Calcium Hypochlorite) · Silene EF (Hydrated Calcium Silicate) · Calcium Chloride · Soda Briquettes (Iron Desulphurizer) · Modified Sodas · Caustic Ash · Phosflake (Bottle Washer) · Calcene T (Precipitated Calcium Carbonate)

COLUMBIA CHEMICALS

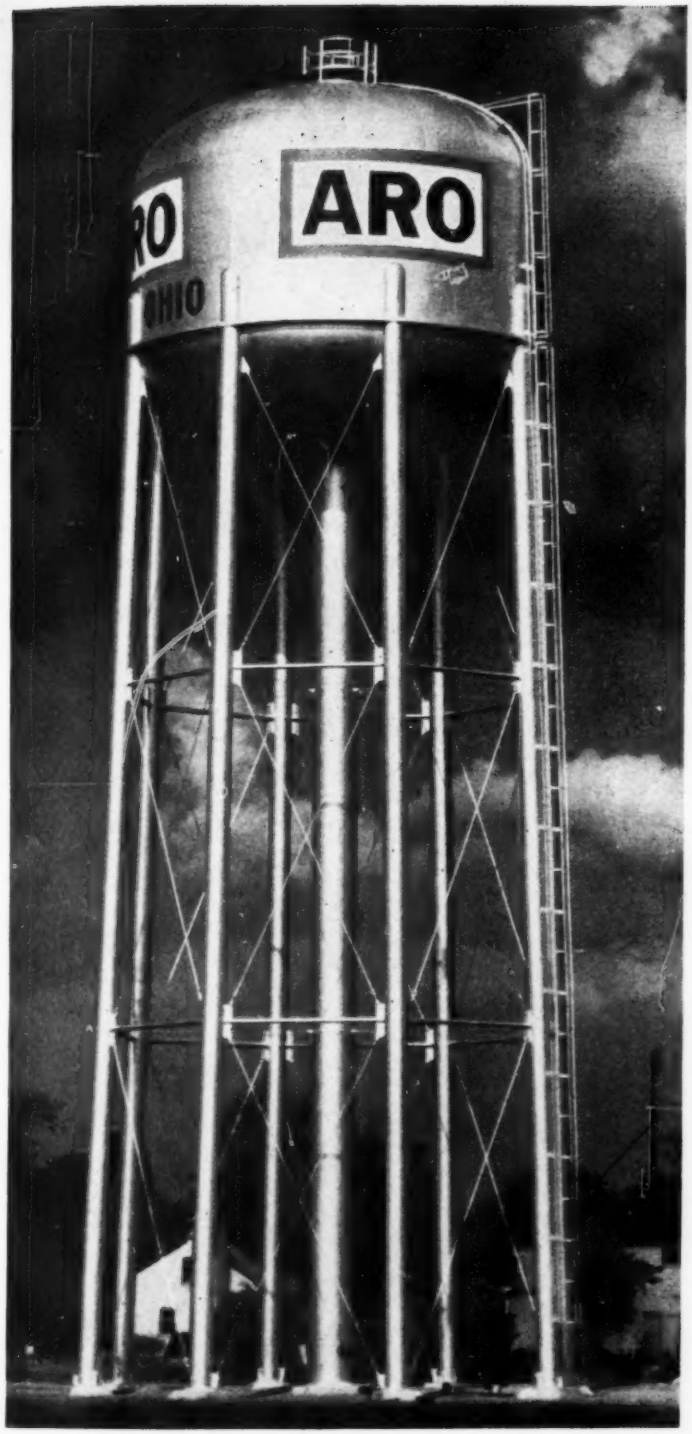
PITTSBURGH PLATE GLASS COMPANY

COLUMBIA CHEMICAL DIVISION

FIFTH AVE. at BELLEFIELD PITTSBURGH 13, PENNA.

CHICAGO · BOSTON · PITTSBURGH · CLEVELAND · NEW YORK · CINCINNATI

ST. LOUIS · MINNEAPOLIS · CHARLOTTE · PHILADELPHIA · SAN FRANCISCO



Photographed by John M. Davidson, Bryan, Ohio
Accepted for Exhibition by the
Commercial Jury in the 1946 Competition of
The Photographers' Association of America
Hotel Stevens, Chicago, Ill.

HORTON *Elevated* TANK....

the first step in building a modern water supply

THE first step taken by the Engineers* responsible for modernizing the water supply system at Bryan, Ohio, was the erection of the 400,000-gal. Horton elevated tank shown at the left. Their plans also include the construction of a 2 m.g.d. softening plant and new high lift pumping units.

The tank is located on the west side of the city as the normal industrial and residential expansion is in that direction. Since the pumping station is located on the east side, it was desirable to erect the tank to the west where the pressures were hardest to maintain with pumps alone. In designing the present improvements, fire flow of 1,500 gpm plus peak industrial and domestic consumption were assumed to occur simulatneously—35 percent to be supplied by the storage tank and 65 percent by the pumping station.

The city has 1,000,000 gals. in reservoirs in addition to the 400,000 gals. in elevated storage. Average daily consumption is 480,000 gals. Pressure at the pumping plant is about 60 lbs. per sq. in. In the past it was raised to 90 lbs. during fires. When the new tank, feeder mains and pumps are in operation, however, it will not be necessary to raise pressures for fires. It is estimated that pumping costs will be reduced 50 percent after the elevated tank is placed in service.

**Jones & Henry, Toledo, Ohio*

CHICAGO BRIDGE & IRON COMPANY

Chicago 4.....2198 McCormick Bldg.
New York 6.....3390-165 Broadway Bldg.
Cleveland 15.....2262 Guildhall Bldg.
Los Angeles 14.....1455 Wm. Fox Bldg.
Birmingham 1.....1586 North 50th St.
Atlanta 3.....2181 Healey Bldg.
Plants in Birmingham, Chicago and Greenville, Pa.

Tulsa 3.....1646 Hunt Bldg.
Houston 1.....5615 Clinton Dr.
Philadelphia 3.....1644-1700 Walnut St. Bldg.
Havana.....Edificio Abreu 402
San Francisco 11.....1283-22 Battery St. Bldg.
Detroit 26.....1551 Lafayette Bldg.
In Canada: Horton Steel Works, Limited, Fort Erie, Ont.

C. I. P. CENTURY CLUB GAINS

Wilmington, Del. Newark, N.J. Boston, Mass.

This year, according to our records, the above named cities, having cast iron mains now in their 100th year of service, are eligible to join the growing group of municipalities already members of the Cast Iron Pipe Century Club. There are no dues, nor any obligation other than to inform us if the qualifying main is taken out of service, or, sold for re-use in another city. Incidentally, the membership outlook for C. I. P. C. C. is promising since many cities have some or all of their original cast iron mains in service, a number of them within hailing distance of the century mark.

Large cities do not keep inefficient mains in service, however old, for sentiment's sake. Cast iron water mains, laid a century or more ago, still function in America's largest cities because they offer additional years, generations, or even centuries, of efficient life. This is what we mean by *efficient* life:

"Cast iron pipe not only offers a century or more of efficient life as a structure—it offers a century or more of efficient life as a carrier. In the limited areas with tuberculating waters,

CAST IRON PIPE

4 NEW CITIES IN '47...

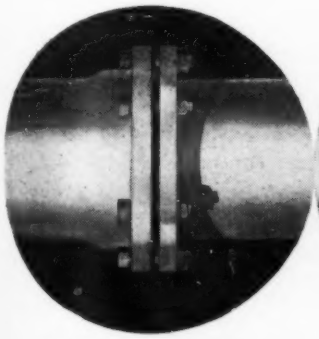
Providence, R. I.

cement-lined cast iron pipe is tuberculation-proof and insures high carrying capacity for the life of the pipe. In the greatly predominating areas without tuberculating waters, the carrying capacity of unlined cast iron pipe remains practically unimpaired for the life of the pipe."

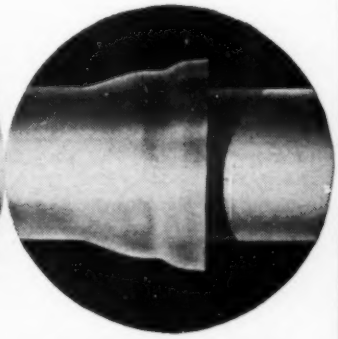
No other pressure pipe material, either on past performance or engineering estimates of performance, comes anywhere near to approaching the combined long life and sustained carrying capacity of cast iron pipe.

Joints for Cast Iron Pipe

A variety of joints are available of which the two most widely used are illustrated below. Special-purpose joints, such as the Ball-and-Socket or Flexible Joint for underwater use, and the Flanged Joint for above-ground use, are also available.



Mechanical Joint — bottle-tight and flexible, now with interchangeable parts.



Bell-and-Spigot Joint — still the standard joint for water and sewerage service.

PUBLIC WATER SUPPLY —the Forgotten Industry

The public takes piped running water for granted—until it's turned off. A good public water supply is not news—except on the rare occasions when something goes wrong. To help create public awareness of the service rendered by America's water supply systems, the Cast Iron Pipe Research Association is presenting little known facts about public water supply to the *six million* influential readers of "Time" and "Nation's Business." For instance, the following excerpts and illustration from a current advertisement.

"rowboats on fifth avenue"

"Imagine enough water to cover Manhattan Island's 22 square miles with a knee-deep flood. That's what the thirty-three million tons of water delivered daily by America's public water supply systems would do.

"Based on weight of product, processed and delivered, public water supply is America's largest industry. In *three days,* this indispensable industry delivers more tons of water than the tonnage produced by the steel industry in a *year!*

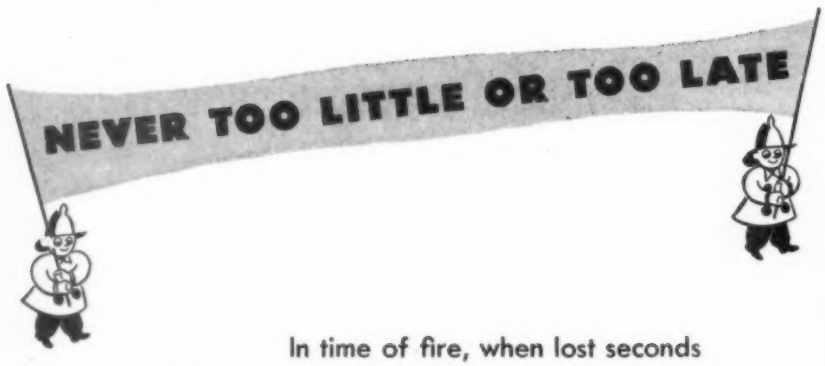
"A good water supply should not be unappreciated or taken for granted. It is the result of farsighted planning and faithful, efficient operation 24 hours a day, every day in the year."

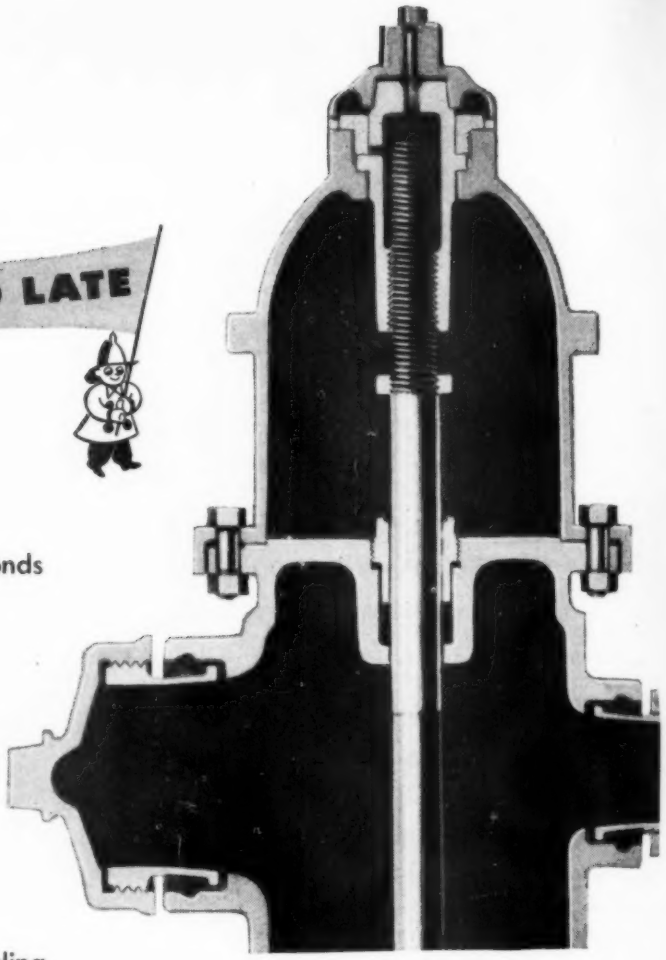
★ ★ ★

Over 95% of the mains, through which this enormous amount of water is distributed, are of cast iron pipe. Typical examples: New York, 97%; Chicago, 99%; Philadelphia, 98%.

Cast Iron Pipe Research Association, T. F. Wolfe, Research Engineer, Peoples Gas Bldg., Chicago 3.

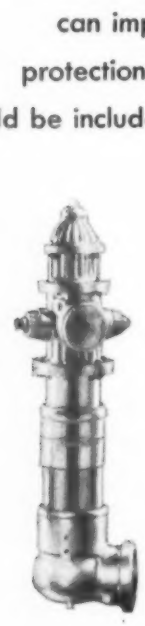
SERVES FOR CENTURIES





In time of fire, when lost seconds seem like eternity, one defective hydrant can make the resources of a community too little—and too late. That's why sure, year-round Mathews performance gives Fire and Waterworks Departments peace-of-mind.

With Mathews on the job, they know they will get full pressure instantly, with no struggling to open the hydrant. That's because the revolving nut with its thread is sealed. No water or dirt from inside . . . no rain or dust from outside can impair operation. The shield nut and the stuffing box provide this all-year protection. The Mathews Hydrant is a basic weapon for fire-fighters, and should be included in the plans of every community.



OTHER FEATURES OF MATHEWS LEADERSHIP

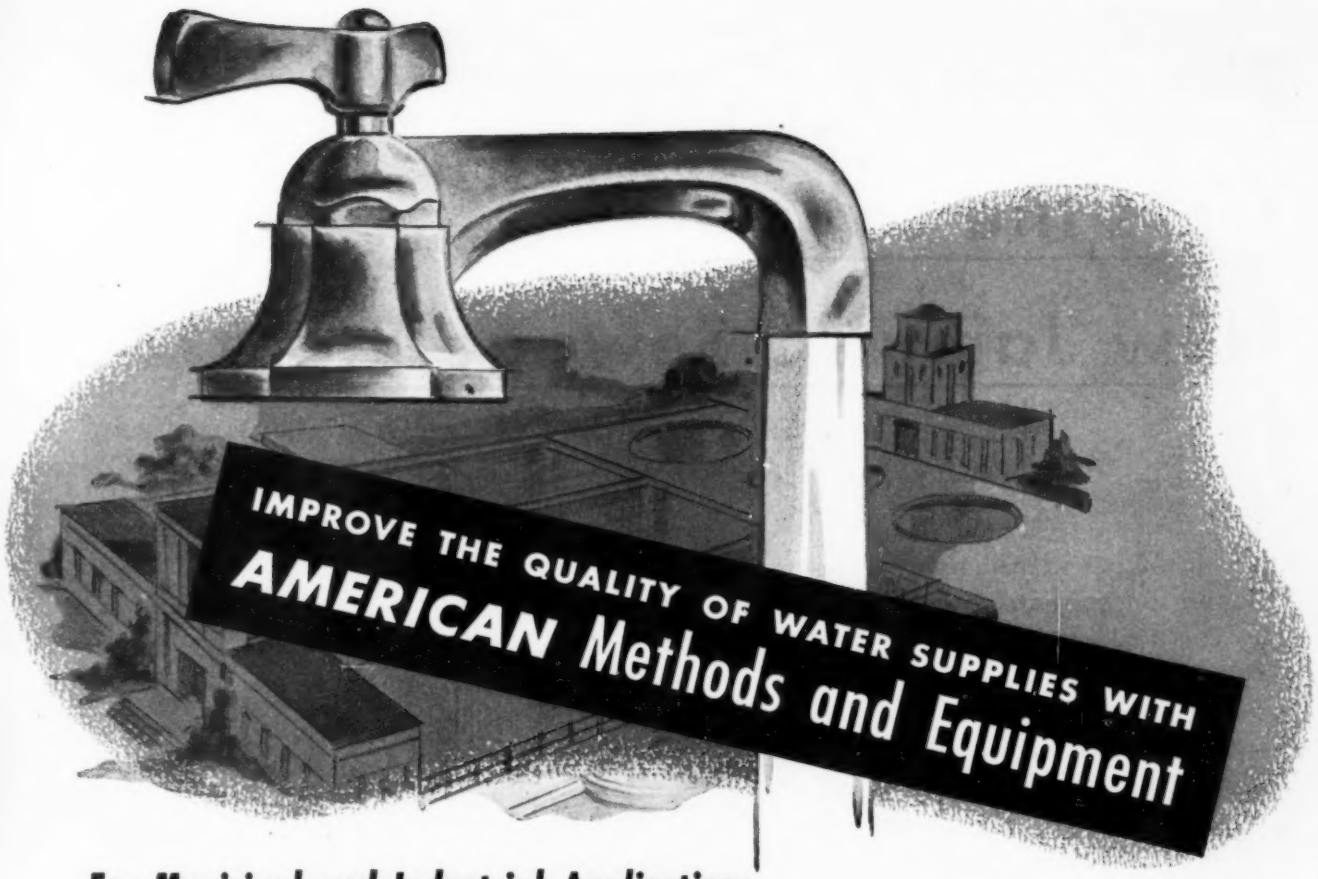
Removable barrel, containing all working parts • Replacement is entirely an above-ground job • Only one part to lubricate—and that only rarely • Head can be rotated 360° on a swivel flange • Replaceable head permits change in nozzle outlets • Nozzle levels can be raised or lowered • Barrel screws into a bronze bushing in elbow • Free moving protection case takes thrust of freezing earth • Positive, automatic drain valve insures dry barrel • A new barrel makes even the oldest Mathews good as new.

MATHEWS HYDRANTS

Made by **R. D. WOOD COMPANY**

PUBLIC LEDGER BUILDING, INDEPENDENCE SQUARE, PHILADELPHIA 5, PA.

MANUFACTURERS OF "SAND-SPUN" PIPE (CENTRIFUGALLY CAST IN SAND MOLDS) AND R. D. WOOD GATE VALVES



IMPROVE THE QUALITY OF WATER SUPPLIES WITH AMERICAN Methods and Equipment

For Municipal and Industrial Applications

Years of experience enable American Well Works to provide installation-tested methods and equipment for supplying potable and properly conditioned water to municipalities, institutions, and industries.

THE FLOCSETTLER — a combination water conditioning unit, consisting of a rapid mix zone, a gentle agitation zone, and a vertical settling tank. The floc bearing water flowing upwards through the sedimentation compartment diffuses through the downward settling slurry. This unit is effectively applied in all cases where it is desirable to use a blanket contact, vertical flow settling tank for turbidity removal, cold water softening, or removal of suspensoids from wastes. Because of its simplicity of operation, it is well suited for municipalities, institutions, camps, and industries. *Bulletin No. 256.*

THE FERROFILTER—combines the latest developments in American and Continental practice. It effectively, economically, and completely removes iron, manganese, and accompanying carbon dioxide from the water supply. Supplants the expensive coke tray aerator and sand filter combination, since the functions of both are carried out in the one Ferrofilter unit. *Bulletin No. 252.*

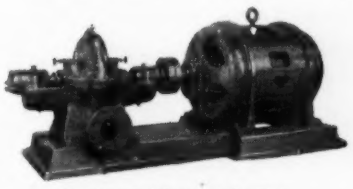
CONTACT AERATOR (Backwashable) — the ultimate in carbon dioxide removal. Continuously and efficiently removes CO_2 from solution to a greater degree than even a freshly recharged coke tray aerator. It consists of a rotary aerator which applies raw water over a shallow trickling filter bed filled with large media (crushed limestone, gravel, or hard coal). *Bulletin SAN 2029.*

MIXING EQUIPMENT—*Downflo Flocculation Unit,* mixes large volume of water at a low velocity. *Recarb Unit,* mixes CO_2 with recirculated liquor drawn from all parts of tank. *Downdraft Aerator,* dispels odors and oxidizes tastes with fine bubble aeration. *Rapid Mix Unit,* for continuous blending of coagulant with raw water. Available with aerator. *Bulletin No. 255.*

ALSO ZEOLITE SOFTENERS, VERTICAL PRESSURE FILTERS, AND SLUDGE REMOVAL EQUIPMENT FOR SEDIMENTATION BASINS.

PIONEERS IN PUMPS

As pioneers in the invention and manufacture of water transfer and deep well pumps, American Well Works has thousands of installations throughout the world filling exacting jobs over long periods.



Horizontal Double Suction

Split case, ball bearing design. Enclosed type bronze impeller with all water passages hand finished and exterior surfaces machined. *Bulletin No. 248.*

Also Single and Two Stage Centrifugals, Axial and Mixed Flow, and Deep Well Turbine Pumps in a wide range of capacities and heads.

Engineering and Laboratory Service *Inquiries on new installations and improvement in existing plants will receive prompt attention. Send us a one-gallon sample of the water to be treated. On the basis of our laboratory's analysis and the bacteriological tests made by your State Board of Health, our Sanitary Engineers can cooperate with consulting and operating engineers in suggesting the process of treatment and the type of equipment required.*

AMERICAN WELL WORKS

102 North Broadway
AURORA, ILLINOIS

Pumping, Sewage Treatment, and Water Purification Equipment
RESEARCH • ENGINEERING • MANUFACTURING

Offices: Chicago • New York • Cleveland • Cincinnati • Kansas City • Sales Representatives throughout the World

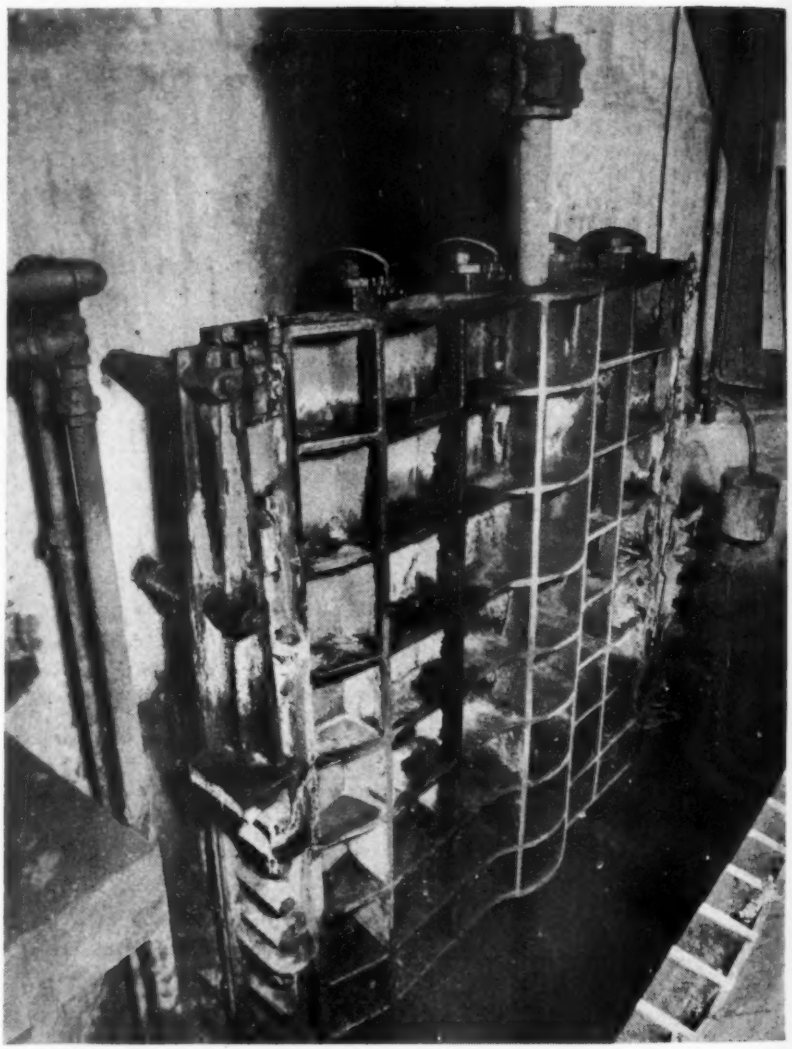
Time-tested *Everdur* Gets the call at New Jamaica Sewage Plant

THIS 8-ft. x 8-ft. main influent control and stop gate at the Jamaica Sewage Treatment Plant of the City of New York, with an unseating load of 50 tons, is restrained by 1" diameter Everdur* bolts imbedded in the concrete. The 4 ¼" diameter operating stem and all other bolts and mounting parts are also made of The American Brass Company's group of Copper-Silicon Alloys.

This equipment was designed and furnished by Krajewski-Pesant Mfg. Corporation, complete with the 32" diameter oil-pneumatic cylinder operating mechanism.

For the past 19 years, Everdur has demonstrated its ability to provide the exceptional corrosion resistance required to give long life under the severe conditions of sewage service. As a result, Everdur is frequently specified at those points where the most destructive conditions are encountered. For detailed information on Everdur Copper-Silicon Alloys in sewage and water works service, write for Publications E-11 and E-5. 46217

*Reg. U. S. Pat. Off.



Where Everdur Serves in New Jamaica Plant...

In four grit ejectors: Everdur for gate slides and cylinders piston rods, valve stems, bolts and nuts.

In two inclined 20-foot diameter revolving disc screens: Slotted Everdur plates for cone and disc.

In 5 hydraulic sluice gates: Bolts, facing strips, and other mounting parts. Also copper-silicon alloy 4 ¼-inch diameter operating stem.

ANACONDA

Everdur

COPPER-SILICON ALLOYS

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

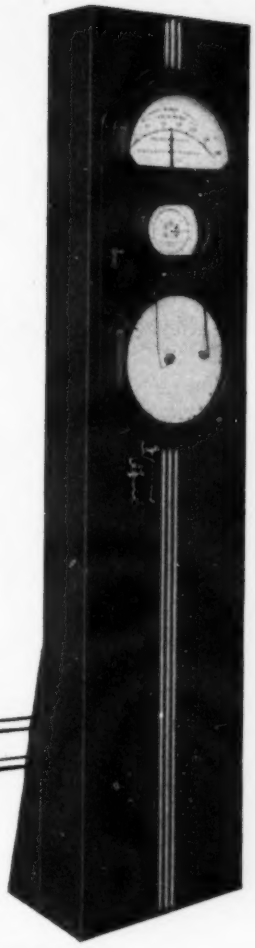
In Canada: ANACONDA AMERICAN BRASS LTD.

New Toronto, Ont.

Accurate . . . Trouble-Free

MAIN LINE METERING

After more than thirty years of service many Builders Type M Instruments and Venturi Tubes are still on the job, metering with original accuracy. The Type M Register-Indicator-Recorder furnishes complete information: a continuous indication of flow, a permanent record on a 12" chart and the total quantity on a counter dial — all within an accuracy of plus or minus 2% over a flow range as wide as 15 to 1.



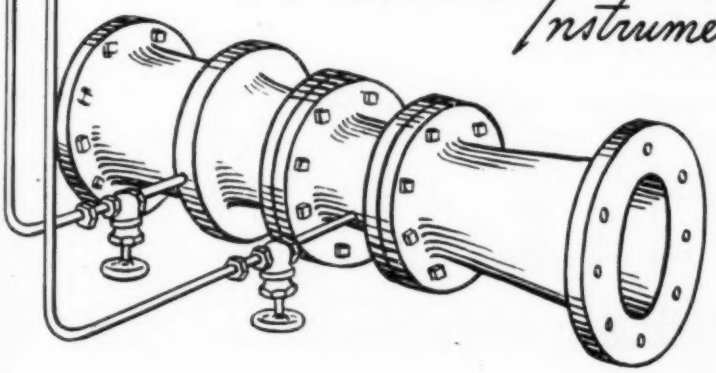
Builders Type M Instrument

The Builders Venturi Tube has no moving parts in the pipe line — nothing to wear out — and the pressure loss is extremely low. Only two small pipes are required to connect the Register-Indicator-Recorder. The Venturi Tube is a complete unit, precisely machined and assembled at the factory — with heavier than usual construction throughout for greater strength and durability. For Bulletin 293C, address Builders-Providence, Inc., (Division of Builders Iron Foundry), 10 Codding St., Providence 1, R. I.

BUILDERS PRODUCTS

Venturi, Propelofio and Orifice Meters • Types M and Flo-Watch Instruments
Venturi Filter Controllers and Gauges • Master Controllers • Kennison
Nozzles • Chronoflo Telemeters • Conveyor Scales

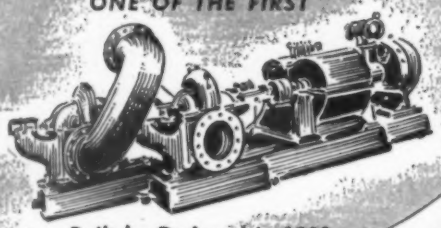
BUILDERS PROVIDENCE
Instruments



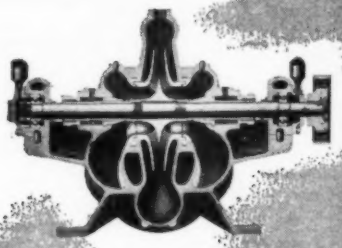
Builders Venturi Meter Tube

45 Years of PUMP IMPROVEMENT

ONE OF THE FIRST

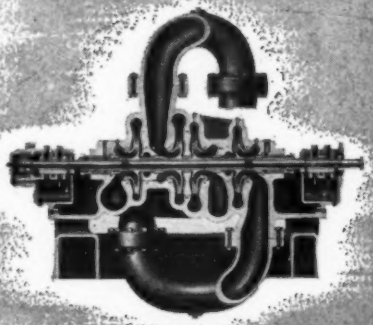


Built by De Laval in 1902

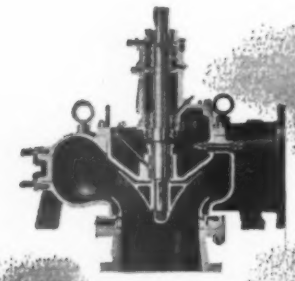


SINGLE STAGE, DOUBLE SUCTION PUMP

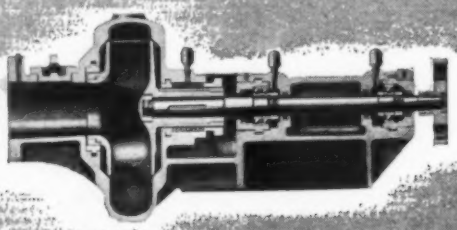
Modern De Laval centrifugal pumps represent the culmination of more than 45 years of continual improvement and perfection. This long period of concentration upon the problems of centrifugal pump design and application places at the user's command a complete line of modern, high quality pumps and a vast store of knowledge concerning pump application problems.



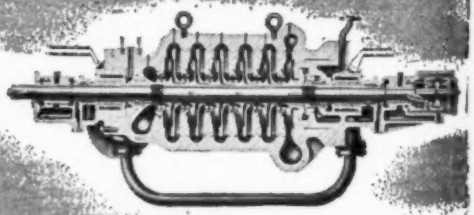
FOUR STAGE, OPPOSED IMPELLER PUMP



MIXED FLOW PUMP



CLOGLESS PUMP



HIGH PRESSURE, MULTI-STAGE PUMP

GP-1

TURBINES • HELICAL GEARS • WORM GEAR SPEED REDUCERS • CENTRIFUGAL PUMPS • CENTRIFUGAL BLOWERS AND COMPRESSORS • IMO OIL PUMPS

DE LAVAL

STEAM TURBINE COMPANY
TRENTON 2, NEW JERSEY

SALES OFFICES: ATLANTA • BOSTON • CHARLOTTE • CHICAGO • CLEVELAND • DENVER • DETROIT • DULUTH • EDMONTON • GREAT FALLS • HAVANA • HELENA • HOUSTON • KANSAS CITY • LOS ANGELES • MONTREAL
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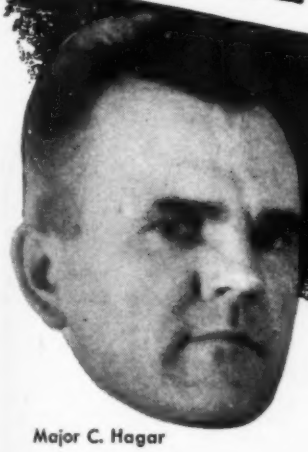
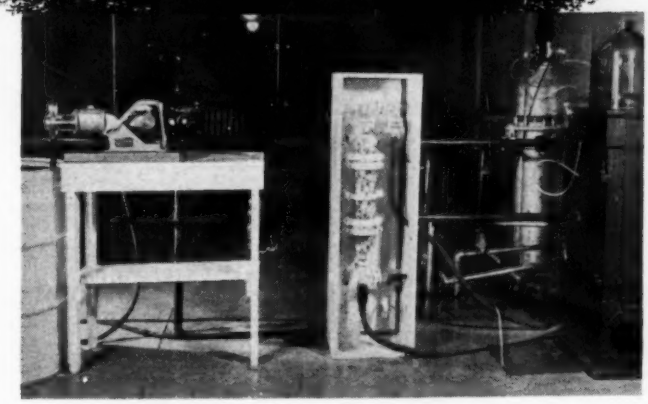
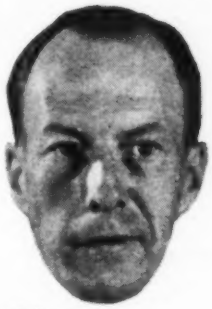
another taste and odor problem solved by Mathieson Chlorine Dioxide!

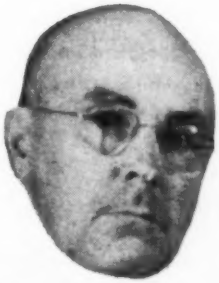


Major C. Hagar





Robert Mounsey



Prof. F. A. Russell

Water Superintendent Major C. Hagar of the City of Lawrence, Kansas, and his staff testify that the cost of Mathieson ClO_2 treatment is small considering its enthusiastic reception by consumers.

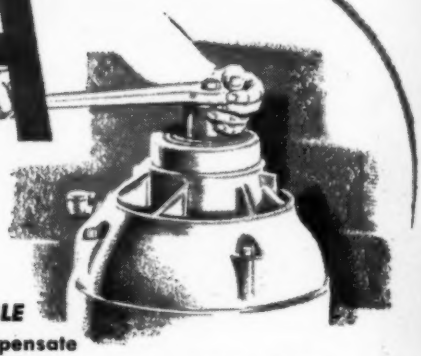
During January and February, 1946, melting snow and ice created especially unpleasant tastes and odors in the Kaw River, water supply for the City of Lawrence, Kansas. Yet, the Mathieson Chlorine—Chlorine Dioxide water treatment was able to cope with even that extreme condition.

Write Mathieson for details of this new technique. It's a development of interest to every water works superintendent. THE MATHIESON ALKALI WORKS (INC.), 60 E. 42nd St., New York 17, N. Y.

Chlorine Dioxide . . . Sanitation HTH . . . Liquid Chlorine
PH-Plus (Fused Alkali) . . . Caustic Soda . . . Soda Ash
Bicarbonate of Soda . . . Ammonia, Anhydrous & Aqua
Carbonic Gas . . . Dry Ice . . . Synthetic Salt Cake
Sodium Chlorite Products . . . Sodium Methylate

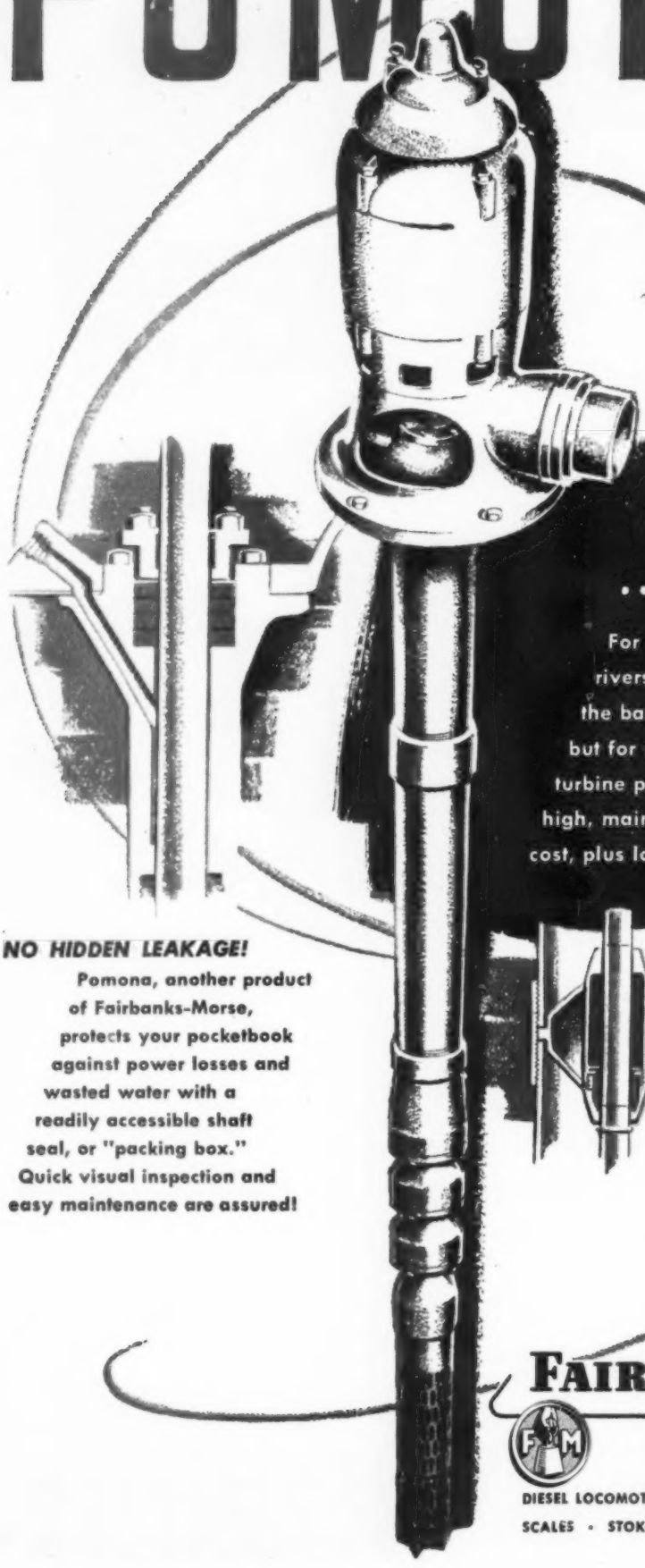
Mathieson
CHLORINE DIOXIDE

POMONA



ADJUSTABLE

You can compensate your Pomona pump for wear—restore proper running clearance when at last it's necessary —by one simple "topside" adjustment. No need to pull the pump to eliminate recirculation; no high adjustment costs—and valuable pumping time is saved!

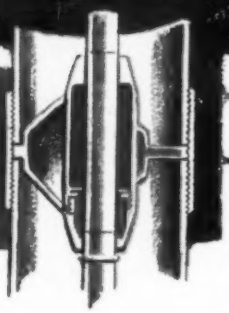


Where there's a well ...here's the way!

For pumping water from wells, pits, sumps, lakes, rivers, etc., here's the way to cut costs per gallon to the barest minimum—not only in the first year, but for many, many years to come! Pomona vertical turbine pumps have the combination you're after—high, maintained efficiency for continued low power cost, plus lowest yearly maintenance expense!

NO HIDDEN LEAKAGE!

Pomona, another product of Fairbanks-Morse, protects your pocketbook against power losses and wasted water with a readily accessible shaft seal, or "packing box." Quick visual inspection and easy maintenance are assured!



WHAT DO YOU NEED? **The patented Pomona revolvable, water-lubricated rubber bearing with double (inside and out) bearing surfaces means quiet vibration-free shaft support under all conditions. Fairbanks-Morse vertical turbine pumps are built in sizes from 4" to 36"—with oil or water-lubrication—semi-open or enclosed impellers. Call your nearest Fairbanks-Morse office or your Pomona dealer for information on the pump best fitted to your job.**

FAIRBANKS-MORSE

A name worth remembering

DIESEL LOCOMOTIVES • DIESEL ENGINES • MAGNETOS • GENERATORS • MOTORS • PUMPS
SCALES • STOKERS • RAILROAD MOTOR CARS and STANDPIPES • FARM EQUIPMENT

"I can't afford to be *without* an adequate supply"

With seasonal high waters and their concurrent taste and odor problems a constant threat, don't be caught short with an inadequate supply of Aqua Nuchar Activated Carbon.

Many water plant operators forestall consumer complaints by constant small dosages of Aqua Nuchar Activated Carbon. This prevents a sudden taste or ordor condition from getting out of control, as a relatively small increase in the amount of Aqua Nuchar will quickly restore the palatability of the water.

Aqua Nuchar Activated Carbon should really be considered as the best type of taste and odor insurance available. A survey of water plants using Aqua Nuchar Activated Carbon year in and year out has shown that the average cost of producing palatable water is less than two cents per capita per year.

Can you afford to be without an adequate supply? If you are not a regular user of Aqua Nuchar, write our nearest office for the location of our nearest warehouse stocks. On your next order you'll be agreeably surprised at the prompt service we can give on Aqua Nuchar.

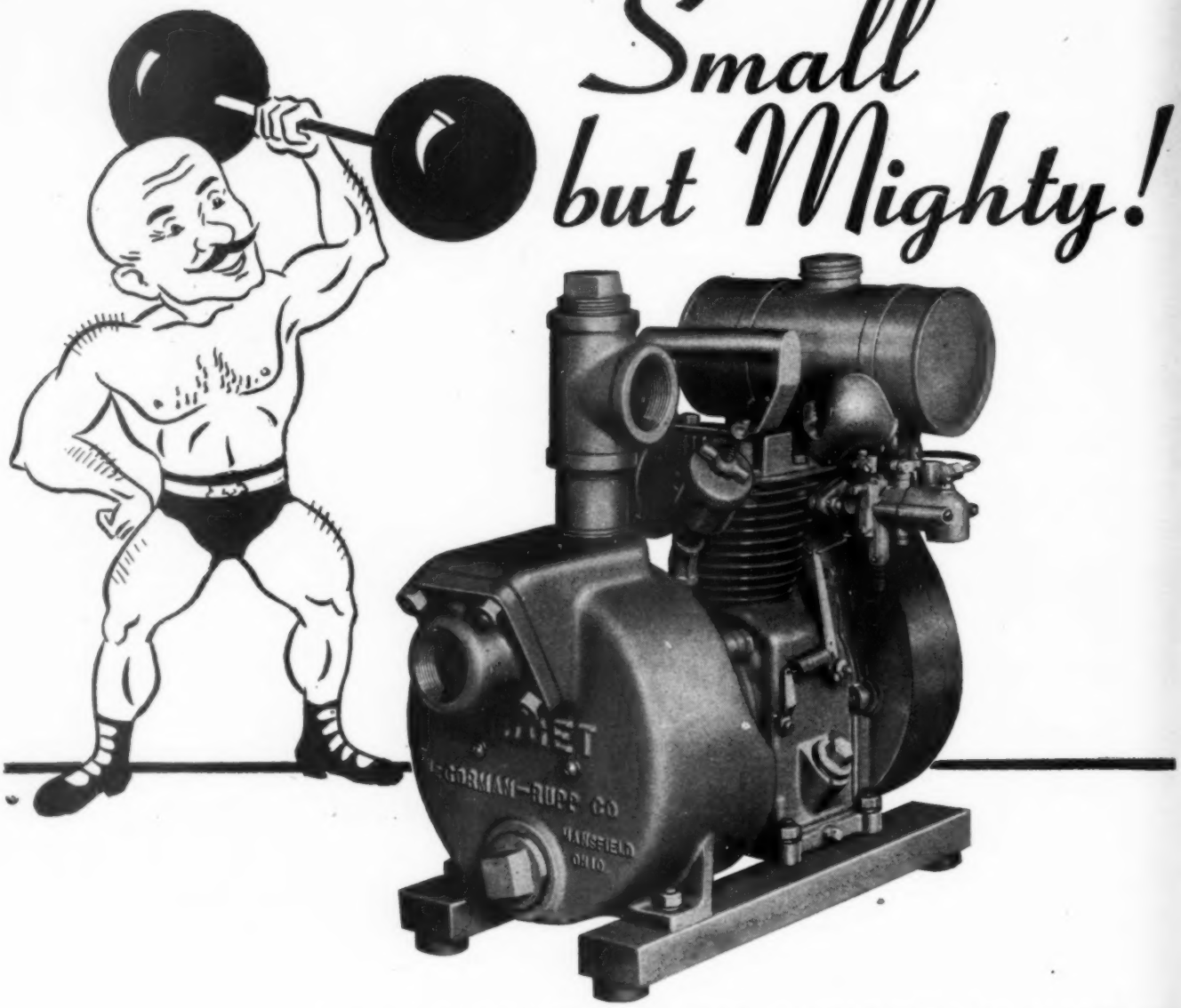
INSURES PALATABLE NUCHAR DRINKING WATER

INDUSTRIAL CHEMICAL SALES

DIVISION WEST VIRGINIA PULP AND PAPER COMPANY

230 PARK AVENUE, NEW YORK 17, N.Y. · 35 E. WACKER DRIVE, CHICAGO 1, ILLINOIS · 748 PUBLIC LEDGER BLDG., PHILADELPHIA 6, PA. · 844 LEADER BLDG., CLEVELAND 14, OHIO

Small but Mighty!



PUMPS SIX TIMES ITS WEIGHT IN WATER

Each Minute of Operation

The Gorman-Rupp "Midget", weighing only 60 pounds, will pump 3000 gallons per hour against a 20 foot head and will do it for months at a time without attention.

The toughest little pump you ever saw and simple to operate -- no valves -- no priming by-passes or other tricks to learn. Fully automatic self-priming -- muck or solids will not clog it.

Gorman-Rupp self-priming centrifugal pumps are made in any size or capacity up to 125,000 gallons per hour and will out-perform any other pump on the market. Our nearest distributor will send you one and let you be the judge.

For Details call your nearest distributor.

THE GORMAN-RUPP COMPANY

GORMAN-RUPP PUMPS — UNSURPASSED FOR PUMPING FAST

327 Bowman Street — **Mansfield, Ohio**

With the demand for pure water at a peak . . .

You

need the dependability of DIAMOND

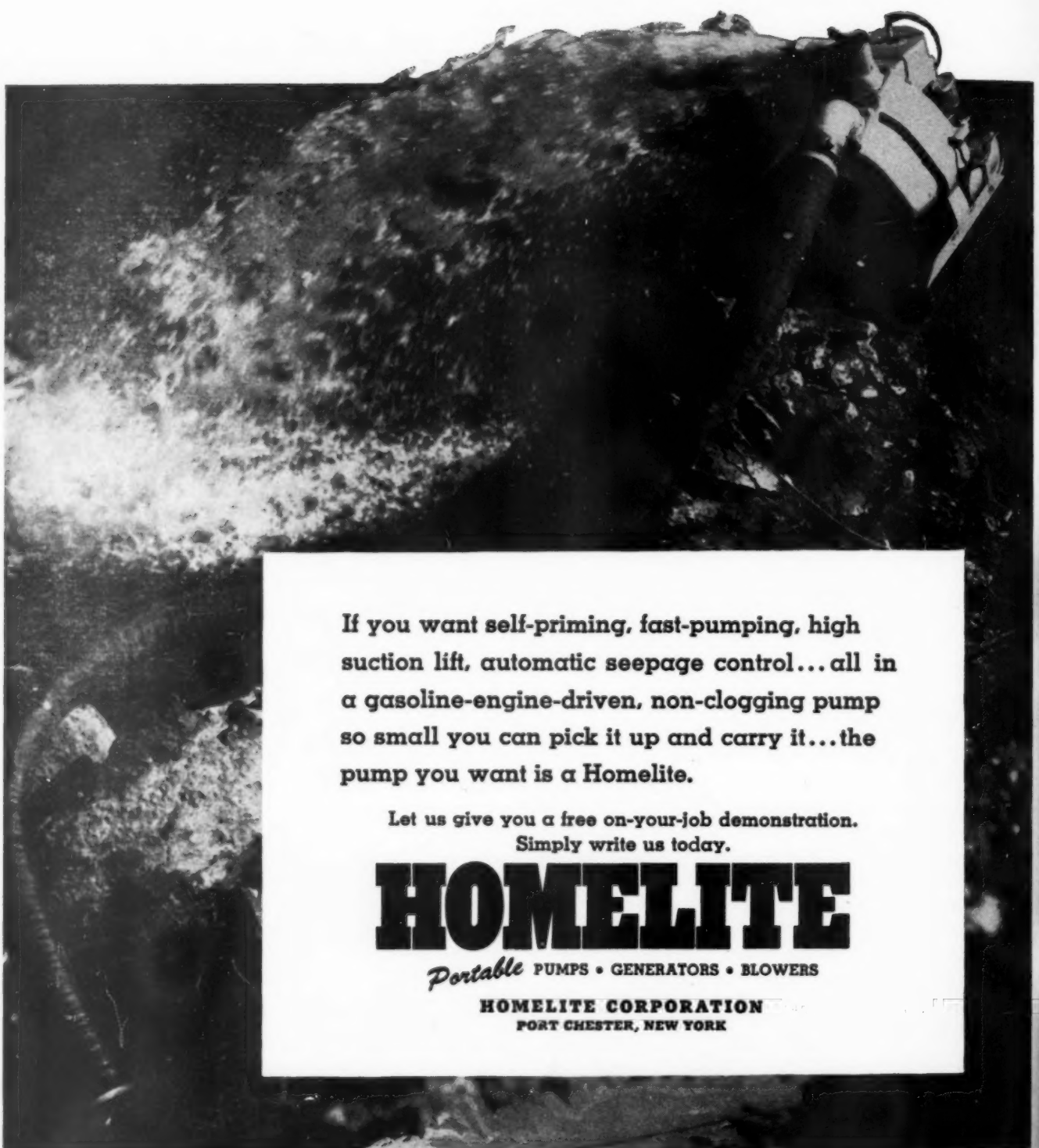
Liquid **CHLORINE**

Because of the ever-increasing demand for water —and today's greater necessity for water treatment—the dependable high quality and uniformity of Diamond Liquid Chlorine are worth more than ever before! Our close control of all manufacturing processes guarantees the year-round high standard of our products.

DIAMOND ALKALI COMPANY

PITTSBURGH, PA. ***and Everywhere***

The Pump
TO PUT ON THE JOB



If you want self-priming, fast-pumping, high suction lift, automatic seepage control... all in a gasoline-engine-driven, non-clogging pump so small you can pick it up and carry it... the pump you want is a Homelite.

Let us give you a free on-your-job demonstration. Simply write us today.

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HOMELITE CORPORATION
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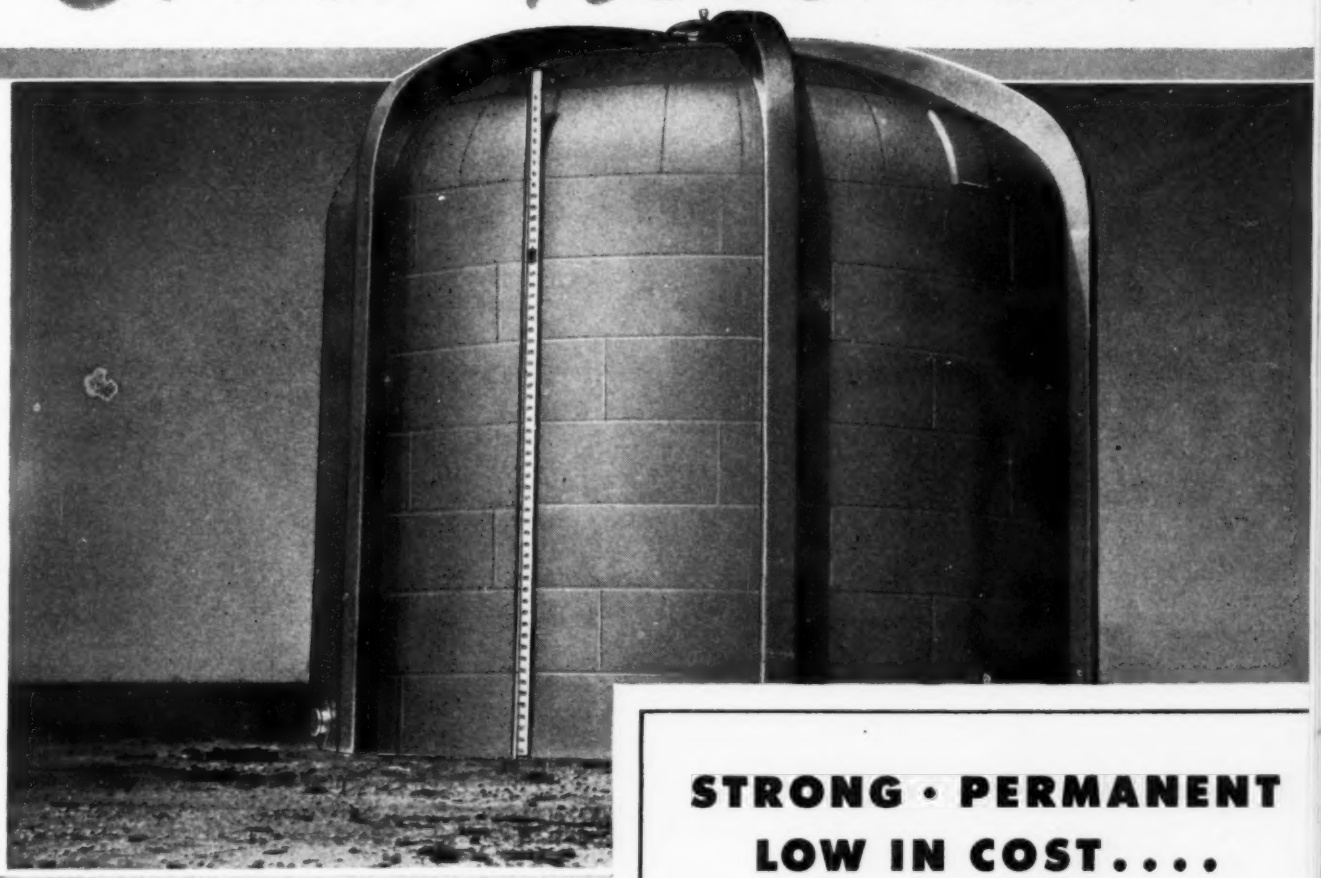
Steel Reservoirs

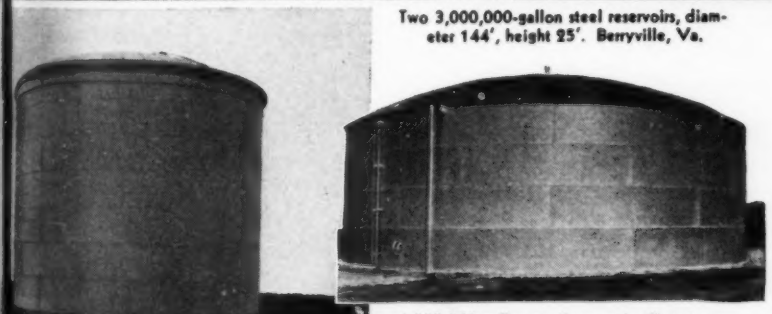


1,200,000-gallon steel reservoir, with ellipsoidal roof and ornamental pilasters. Diameter 80', height to roof 51'. Midland, Tex.

STRONG • PERMANENT
LOW IN COST....

for economical water storage!

Two 3,000,000-gallon steel reservoirs, diameter 144', height 25'. Berryville, Va.



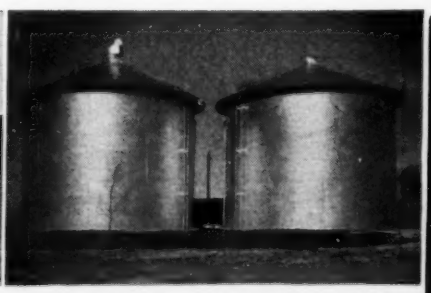
1,000,000-gallon steel reservoir, diameter 84'3", height 24'10". Bottineau, N.D.

1,500,000-gallon steel reservoir, with ornamental cornice. Capitol Heights, Md.

Steel—with its strength, permanence and low maintenance—offers the best service and greatest overall economy in water reservoir construction.

Steel Reservoirs by Pittsburgh-Des Moines provide these advantages fully—plus the design engineering experience, modern fabrication, expert erection and guaranteed satisfaction typical of this responsible organization. *Write for a quotation on your projected reservoir requirements, of any type or size!*

[illegible]-gallon steel reservoir, ellipsoidal roof; [illegible] height 25'. Fort Benton, Mont.



Two 100,000-gallon steel reservoirs, cone roof; diameter 30', height 21'. Atlantic, Iowa.

PITTSBURGH • DES MOINES STEEL CO.

Pittsburgh, Pa., 3418 Neville Island — Des Moines, Iowa, 919 Tuttle Street

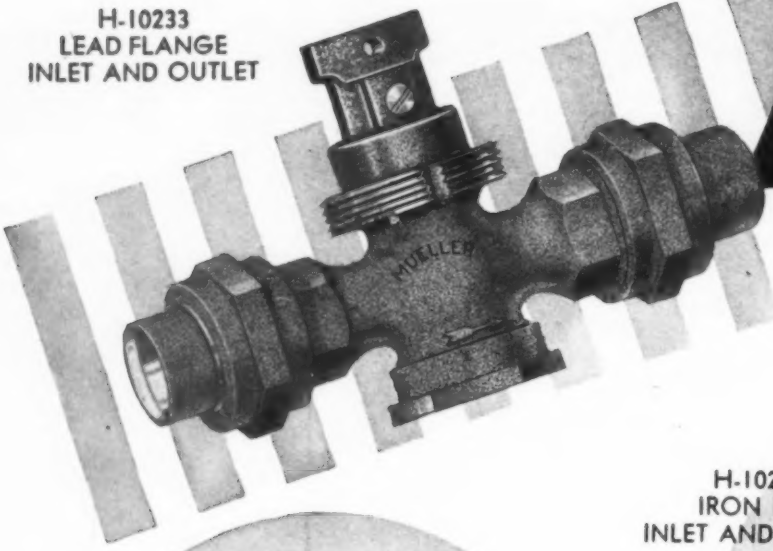
New York, Room 915, 270 Broadway

Chicago, 1222 First National Bank Building • Dallas, 1223 Praetorian Building

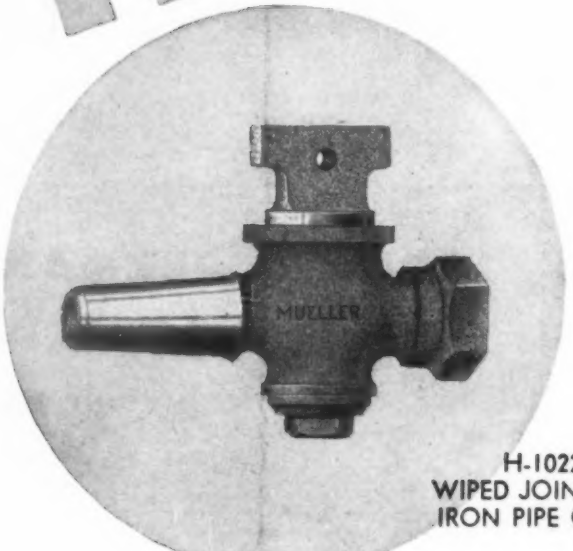
San Francisco, 625 Rialto Building • Seattle, 526 First Avenue, South

LOOK AT THESE CURB STOPS

H-10233
LEAD FLANGE
INLET AND OUTLET



H-10201
IRON PIPE
INLET AND OUTLET



H-10221
WIPED JOINT INLET
IRON PIPE OUTLET

Regardless of the type of connection you are called upon to make, you will always find a Mueller Curb Stop that is made for that particular condition. All of them are "Ground Key", which means each heavy plug is ground and lapped into its rugged body, insuring easy turning, an accurate seal, and dependable long-life service. For complete satisfaction, always install Mueller Brass Goods.

H-15125
COPPER PIPE INLET
IRON PIPE OUTLET

MUELLER CO.
DECATUR, ILLINOIS
LOS ANGELES, CALIF.
SARNIA, ONTARIO, CAN.

CHEMICAL USERS' GUIDE To General Chemical Company Products for Treatment of Water, Sewage, and Industrial Wastes

PRODUCT	AVAILABLE FORMS	COMMERCIAL STRENGTH (MIN.)	SHIPPING CONTAINERS	APPLICATIONS
Aluminum Sulfate $Al_2(SO_4)_3 \cdot 14H_2O$ approx. *(Filter Alum)*	Commercial & Iron Free: Lump • Ground Powdered	17.25% Al_2O_3	Bags Barrels • Drums Bulk Carloads	Coagulant for water and sewage. Dewatering conditioner for sewage sludge. 1% Sol. pH 3.4.
Aqua Ammonia NH_4OH plus Water *(Ammonia Water)*	Colorless Liquid	26°Be. (29.4% NH_3)	Steel Drums Carboys	Used with chlorine to form chloramines for water disinfection.
Ammonium Aluminum Sulfate $Al_2(SO_4)_3 \cdot (NH_4)_2SO_4 \cdot 24H_2O$ *(Ammonia Alum) (Crystal Alum)*	Lump Nut Granular Powdered	11.2% Al_2O_3	Bags Fibre Drums	Coagulant for water. Advantageous for pressure filters. Supplies ammonia for chloramine formation. 1% Sol. pH 3.5.
Sodium Bisulfite, Anhydrous $Na_2S_2O_5$ *(ABS) (Sodium Metabisulfite)*	Powdered	97.5% $Na_2S_2O_5$ (Equiv. 65.5% SO_2)	Fibre Drums	Antichlor. Remove iron and manganese deposits from filter sand. 1% Sol. pH 4.6.
Sodium Silicate $Na_2O \cdot X(SiO_2)$ plus H_2O *(Water Glass) (Silicate of Soda)*	Viscous Liquid	38° to 52°Be. Various Ratios of Na_2O:SiO_2	Drums Tank Cars Tank Trucks	1. Aid in floc formation. 2. Prevent red water corrosion in distribution lines. 1% Sol. pH 12.7
Sodium Thiosulfate $Na_2S_2O_3 \cdot 5H_2O$ *(Hypo) (Sodium Hyposulfite)*	Crystals: Prismatic Rice Selected Universal Granular	99.75% $Na_2S_2O_3 \cdot 5H_2O$	Bags Barrels Fibre Drums	Antichlor. Water solution is neutral.
Sulfuric Acid H_2SO_4 plus H_2O *(Oil of Vitriol)*	Corrosive, oily liquid Various strengths	66°Be. (93.19% H_2SO_4)	Bottles Carboys Drums Tank Trucks Tank Cars	1. Reduce pH and alkalinity. 2. Regenerate carbaceous zeolites and ion exchangers. 3. Activate Baylis Silicate.
Potassium Aluminum Sulfate $Al_2(SO_4)_3 \cdot K_2SO_4 \cdot 24H_2O$ *(Potash Alum)*	Lump Nut Granular Powdered	10.7% Al_2O_3	Bags Fibre Drums	Coagulant for water. Slow, even rate of solubility desirable for solution pot feeders. 1% Sol. pH 3.52.
Sodium Sulfite, Anhydrous Na_2SO_3 *("Sulfite")*	Granular Powdered	98.5% Na_2SO_3	Bags Fibre Drums	Antichlor, oxygen remover. Weak solutions absorb oxygen readily. 1% Sol. pH 9.8.
Sodium Sulfate, Crystal $Na_2SO_4 \cdot 10H_2O$ *(Glauber's Salt)*	Crystal & Needle Crystal	96% $Na_2SO_4 \cdot 10H_2O$	Barrels Bags Drums	Neutral Solution. Boiler water treatment (maintenance of sulfate-carbonate ratio).
Sodium Sulfate, Anhydrous Na_2SO_4	Powdered	99.5% Na_2SO_4	Bags Barrels	Neutral Solution. Boiler water treatment (sulfate-carbonate ratio)
Trisodium Phosphate $Na_3PO_4 \cdot 12H_2O$ *(TSP)*	Crystal	98.5—103% $Na_3PO_4 \cdot 12H_2O$ (Equiv. 19% P_2O_5)	Bags Barrels Fibre Drums	Boiler water treatment. Cleaning compound. 1% Sol. pH 11.8-12.0.
Disodium Phosphate, Crystal $Na_2HPO_4 \cdot 12H_2O$	Crystal	98% $Na_2HPO_4 \cdot 12H_2O$ (Equiv. 19.5% P_2O_5)	Bags Barrels Fibre Drums	Boiler water. (Calcium and magnesium precipitation.) 1% Sol. pH 8.4.
Disodium Phosphate, Anhydrous Na_2HPO_4	Powdered Flake	96% Na_2HPO_4 (Equiv. 48% P_2O_5)	Same	Same as Crystal, but stronger product.
Sodium Fluoride NaF *(Fluoride)*	Powdered (white or blue colored: Nile Blue) Light or dense	90% and 95% NaF	Bags Barrels Fibre Drums	Fluorination of water supplies. (For information, consult with local health officers.)

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FOR AMERICAN INDUSTRY

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In Wisconsin: General Chemical Wisconsin Corporation, Milwaukee, Wis.

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R-S valvEvents

ISSUED PERIODICALLY BY R-S PRODUCTS CORPORATION, PHILADELPHIA 44, PA., FOR THOSE CONCERNED WITH FLOW CONTROL AND SHUT-OFF

The Iron Hand in the Velvet Glove

Patented renewable replaceable rubber liner

Installing liner in valve body

Rubber liner in position

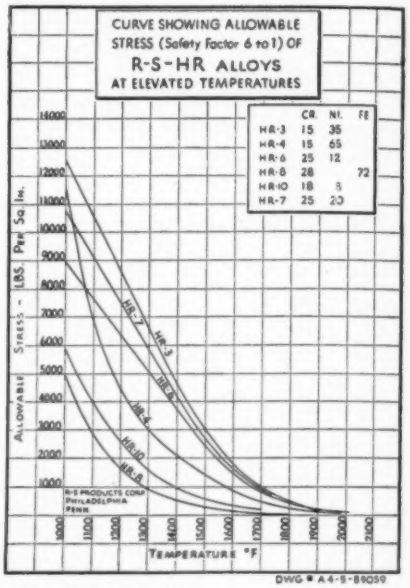
Old-timers who think of a butterfly valve as a "slap-happy damper," or as a valve that "always leaks" even when presumably tight-closed, are looking pop-eyed at the performance of the new R-S rubber-sleeved Butterfly Valve.

This is the modern equivalent of the iron hand in the velvet glove, with the trifling difference that it's a steel hand in a rubber glove.

The rubber spool (patented) is renewable and replaceable. Months of experimentation were given to developing a rubber of precisely the right characteristics of flexibility and toughness within the temperature range of −20° to plus 200°F. The spool, which fits somewhat loosely within the valve body, acts as a seat and seal for the wedge-type closing action of the butterfly vane. As the vane approaches the closed position, the rubber bunches up around the periphery of the vane, including the critical points in the area of the shaft-bosses, and forms a perfect seal.

The new valve has been subjected to rigorous tests proving its ruggedness and efficiency. One of the most satisfactory tests, because not carried out under laboratory conditions, was engineered by a manufacturer of powdered glue. He set the valve up in a line so it could be fully opened by a cam, then slammed shut by a 50-pound weight. This test was repeated 9,000 times. At the end of the test, the rubber-sealed valve was still giving perfect closure. The new R-S rubber-sealed valve is available in sizes to handle 15 to 125 p.s.i. using 125-pound standard American flanges.

One of its great advantages is the ease of replacement, though the evidence of many tests indicates this will seldom be necessary. The method is shown in pictures at left. The flanges of the spool line up with the metal flange bolt-holes and eliminate the need for the usual flange-gaskets, a worth-while economy.



"Hard to Get"

Information on the behavior of metals at temperatures above 1200° is not easily come by. The curves herewith have been worked out by R-S Engineers to show the stress resistance of various heat resistant metals at elevated temperatures.

H-R metals are stainless steels and stainless iron developed through study of valve requirements. Three of these metals show allowable stress of 2000 p.s.i. between 1500° and 1600°F., and 1000 p.s.i. at nearly 1700°F.

The relative paucity of information on stress resistance at high temperatures gives the chart unusual value to engineers. A copy may be had by inquiry of D. W. Hopkins, Vice President, Valve Division, R-S Products Corporation.

R-S Fights Inflation

The opportunity is present for many manufacturers to make the most of freedom from OPA ceilings on machinery. Many are using elevator clauses ruthlessly so that the buyer cannot even guess approximately the spread between ordering price and delivery price.

R-S Products' cost system is such that their Production Department can tell what it costs to make a given type and size of R-S Butterfly Valve today as compared with what it cost last Tuesday. Thus they are in a position to hold increases to a minimum as well as keep clear of runaway guesswork pricing.

Versatile Butterfly Valves

The high efficiency and low cost of Butterfly Valves is widely known but not generally recognized, paradoxical as this may sound. Actually, the fields in which Butterfly Valves are operating with characteristic efficiency are as wide as Industry itself. Users include the biggest names in air-conditioning and refrigeration, aviation, chemical processing, coke, foundries, heat-treating, heat exchange systems, production and refining of oil, paper and pulp mills, rubber production, sewage and water works, shipyards, soap plants, solvent recovery systems, steel mills, sugar refineries, textile and dye-works, and power plants generally.

Complete R-S Valve Installation Data

Engineers like the complete dimensional data supplied for R-S Butterfly Valves. Dimensions are tabulated by standard sizes under stock types and identified by letters corresponding to detailed drawings which accompany the tables. Six full pages of R-S Products' Catalog No. 14-B (copy on request to R-S Products Corporation, Wayne Junction, Philadelphia 44, Pa.) are devoted to this basic installation data.

JMLco P-A2

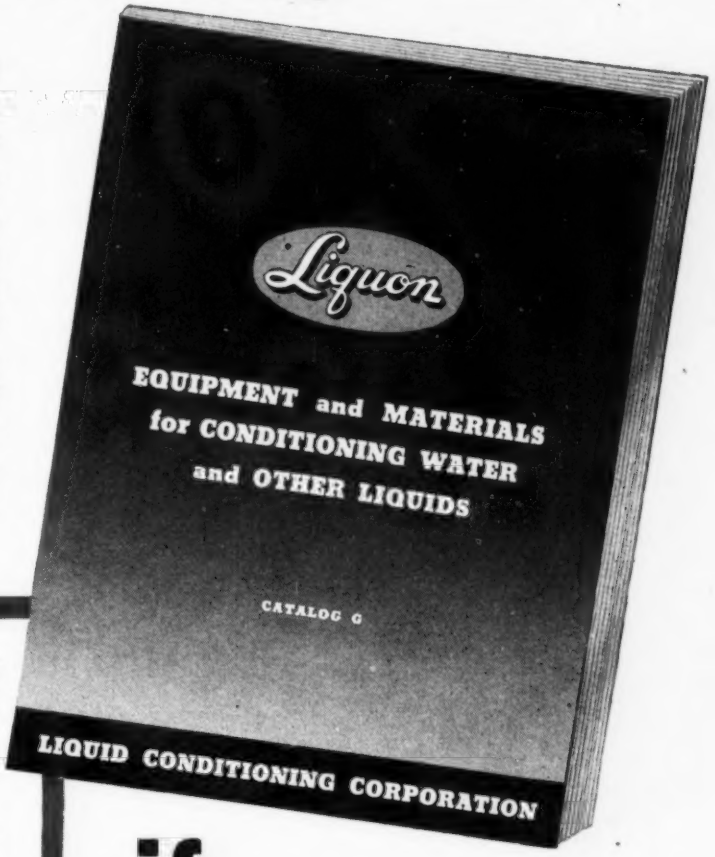
Kone Takes Over Washington

It is amazing how things are changing in Washington these days! First the Republicans—well, you know about that! Now Kone Engineering Company of 11 West 25th Street, Baltimore, is taking over the Washington D. C. territory for R-S Valves. Kone has been Baltimore distributor for R-S Valves for some time past and continues to handle the Baltimore territory. He will handle Washington from the present Baltimore office.

The Latest Word in the CONDITIONING *of* WATER *and* OTHER LIQUIDS

This helpful guide book on conditioning of water and other liquids has been prepared by leading authorities with more than a quarter century of specialized experience in this field.

It clearly explains and compares the many different processes and describes the most modern and effective methods and equipment for softening and clarifying water, and also for removing undesired impurities or recovering valuable constituents from other liquids. It will help you to determine the most practical conditioning method for your particular requirements, and to check the possibilities for modernizing and improving your present process.



Some of the Subjects Covered

WHY are different methods of water treatment in use?

HOW do these different methods of water treatment compare in the results obtained?

WHERE should each of the different methods of water treatment be used?

WHAT are the most advanced methods and equipment for water treatment?

WHICH is the most effective water treatment for removing hardness . . . alkalinity . . . minerals . . . turbidity . . . gases . . . other impurities?

WHEN can an existing water treatment installation be made more efficient with the same equipment?

if your plant operations require water treatment or liquid conditioning of any kind, this 60-page bulletin may point the way to important improvements or economies.

LC 106

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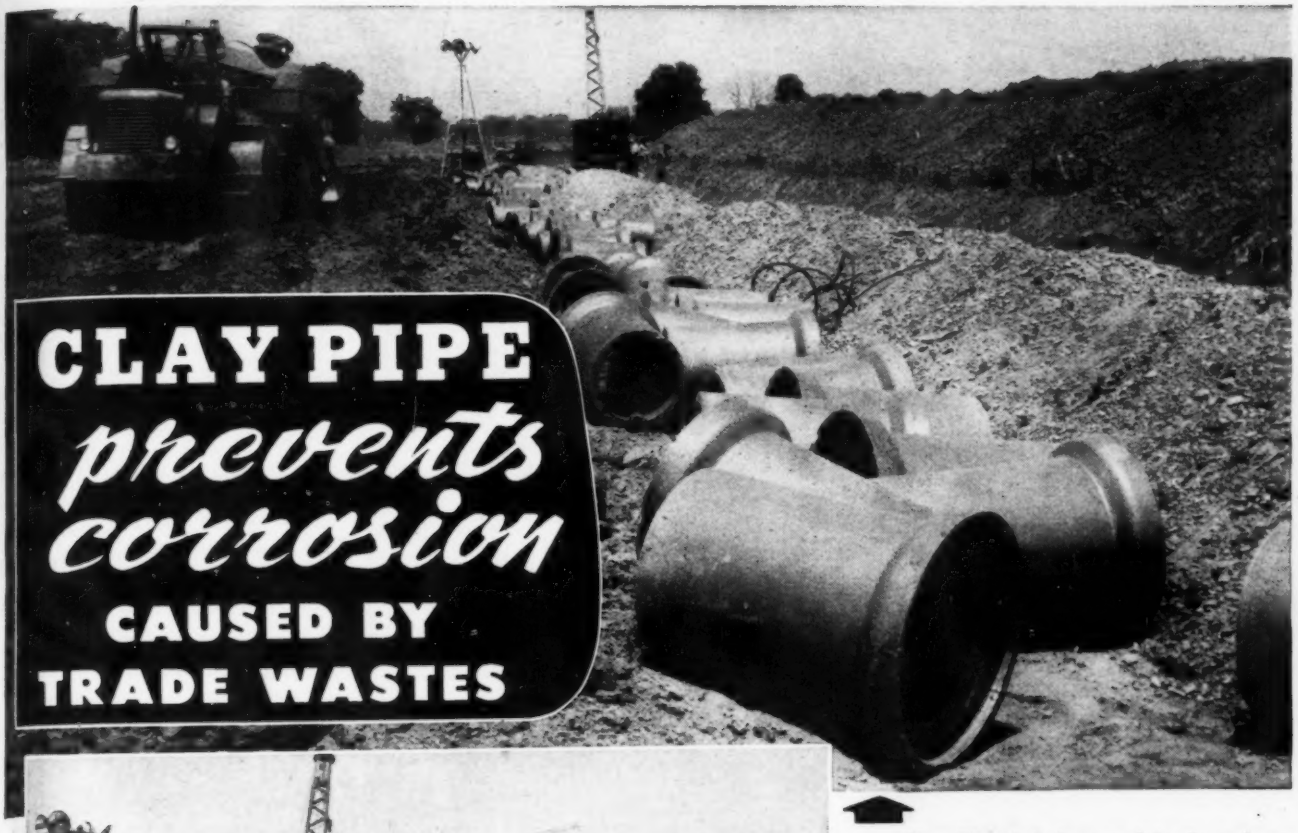
City Truck Pulling Two Machines

Pulls the clam-type bucket up to the load, then brings the loaded bucket back up to street level for dumping—SAFELY, at a speed of up to 125 feet per minute. No manholes to muck out!

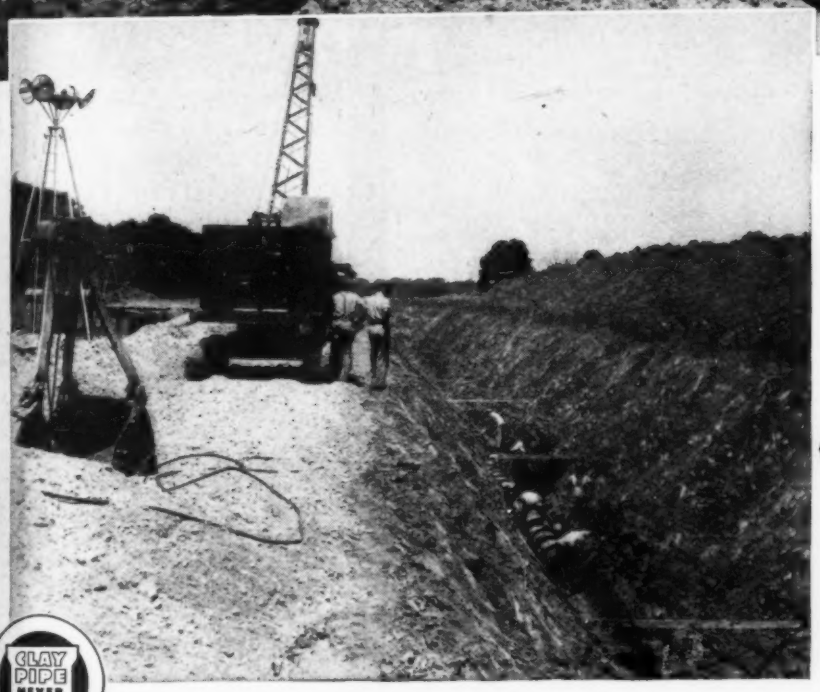
Drums hold up to 1,000 feet of ½" cable. Seven sizes clam-type buckets—powerful 7.7 motor-automatic safety clutch—power clutch—fool proof cable winder. Write for complete catalog today—

FLEXIBLE SEWER-ROD EQUIPMENT COMPANY

9059 Venice Boulevard, Los Angeles, Calif.



CLAY PIPE *prevents corrosion* CAUSED BY TRADE WASTES



Clay Pipe is being used in the relocation and replacement of sewers made necessary by construction of a flood wall to protect Parkersburg, W. Va., from the Ohio and Kanawha Rivers.

Heavy loads are imposed on the pipe, because there is 15 feet of cover in some places, but the Clay Pipe specified more than meets this load requirement.

Industrial wastes containing hot muriatic and sulphuric acids from the Parkersburg Iron and Steel Co., will pass through this 30-inch corrosion-proof Clay Pipe. This $500,000 flood project is being handled by the U. S. War Department, with Col. B. B. Talley, Dist. Eng., and Lt. Col. Harry Pockras, Asst. Dist. Eng., in charge.

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Vitrified Clay Pipe is the only pipe engineers can be *sure* of to withstand the attack of any acid found in sewage and industrial wastes. Corrosion, rust, decomposition and abrasion are never problems with Clay Pipe installations. Made of nature's indestructible raw materials fused into the desired shape by vitrification . . . Clay Pipe has no equal in long, trouble-free performance records.

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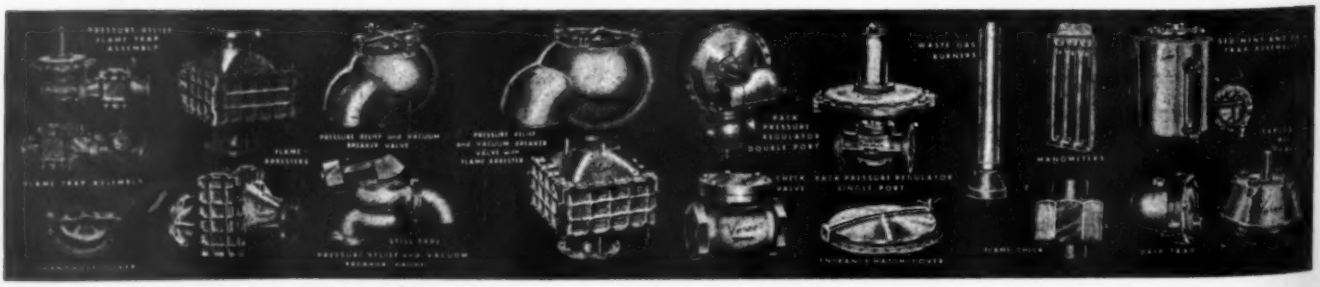

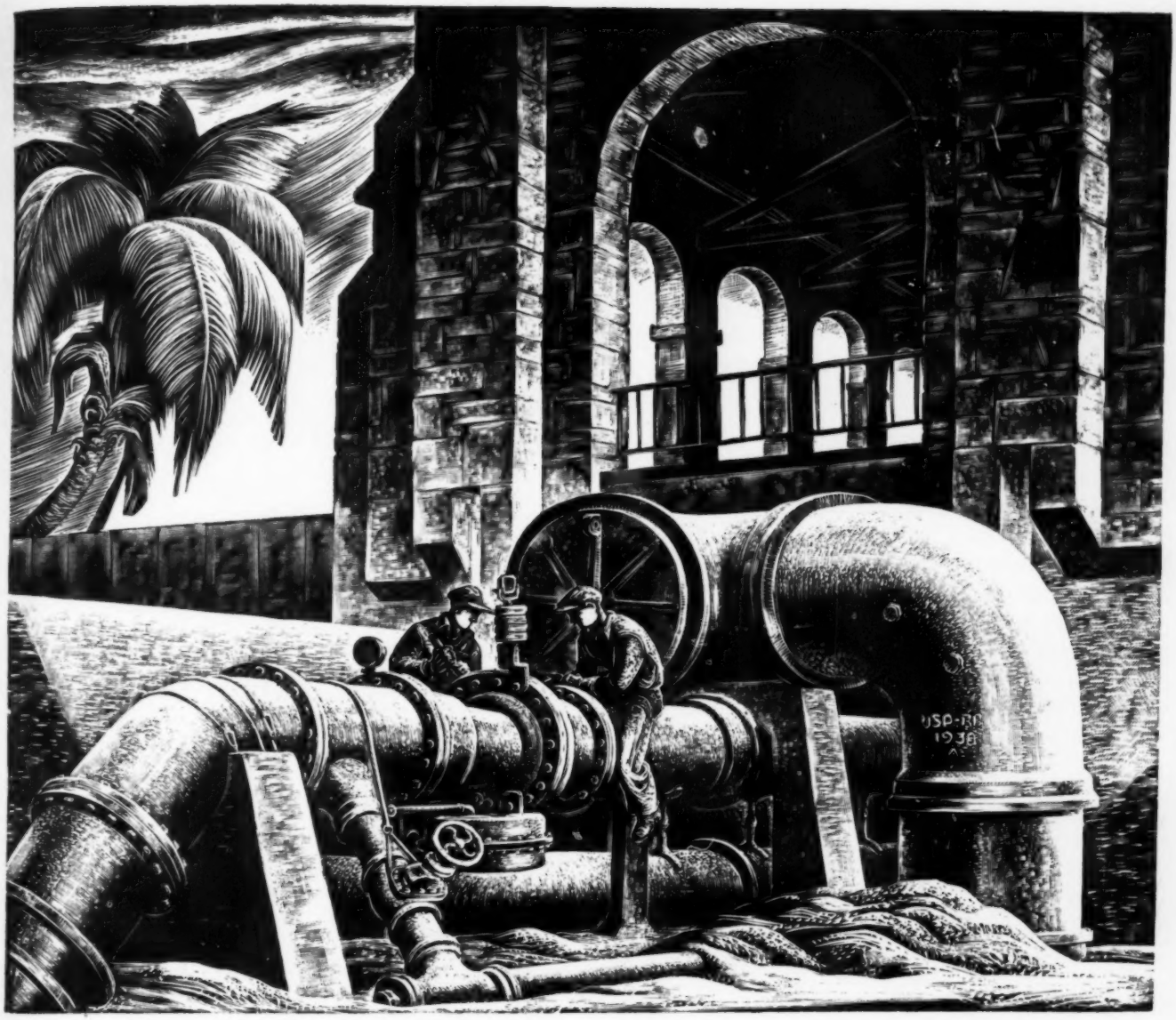

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If you are planning on using chlorine in your sewage treatment, you can insure consistently uniform results by specifying Hooker Chlorine.

Because users know that they can depend on Hooker for uniform high quality, Hooker Liquid Chlorine is being specified by many sewage treatment plants and is the favorite there, as it has been among water works officials since Hooker first produced Chlorine over forty years ago.

Hooker's Technical Staff, with a background of experience that started with early commercial production of chlorine is at your service in solving your problems involving chlorine, and the other Hooker Chemicals.

"Hooker Liquid Chlorine" is a booklet which contains helpful information on this chemical and includes sections on materials for equipment, precautions, physical and chemical data and useful tables. Every water works and sewage official should have a copy. Available free when requested on your letterhead.

*"Results of Effluent Chlorination at Cleveland." Water Works and Sewerage, Aug., 1944, page 300.

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Dependable!
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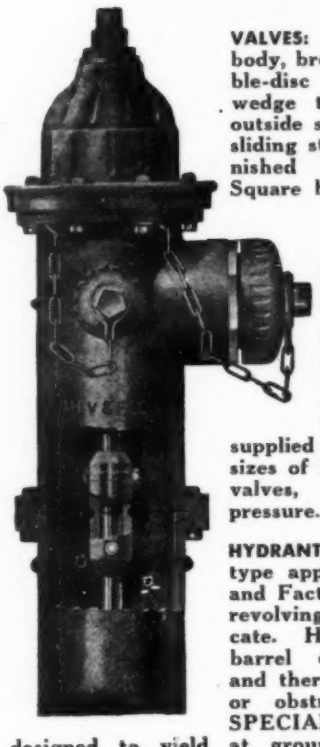

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Hydraulically Operated: For remote control of operation and for quicker, easier opening or closing. Can be supplied in any of the standard sizes of M & H A.W.W.A. gate valves, either high or low pressure.

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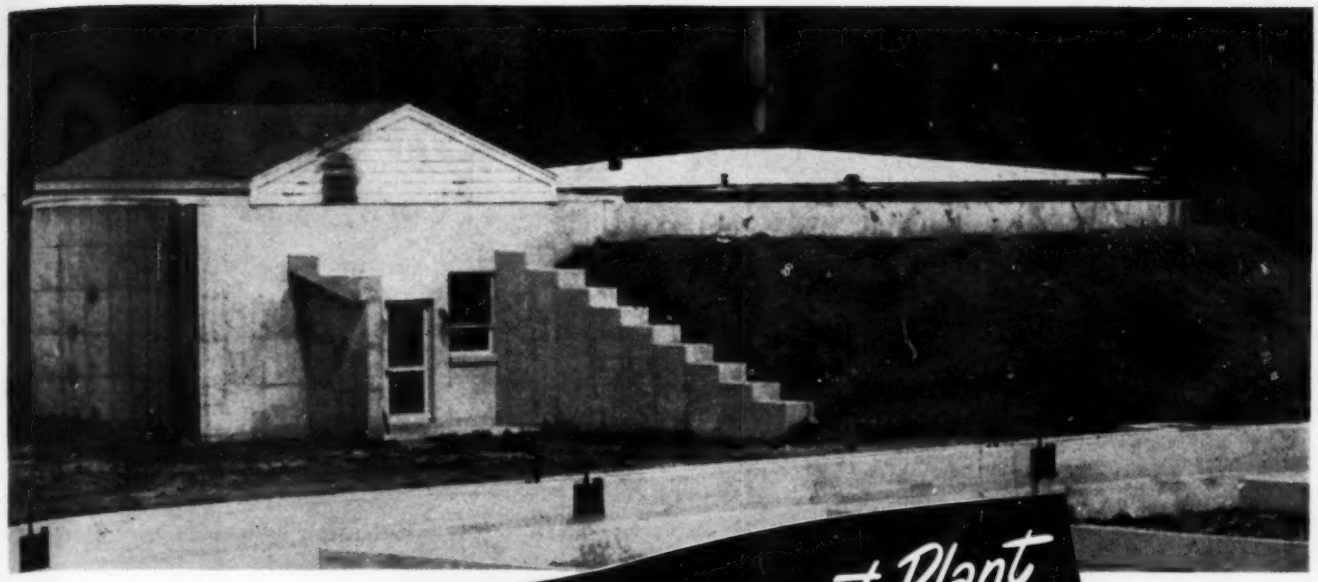
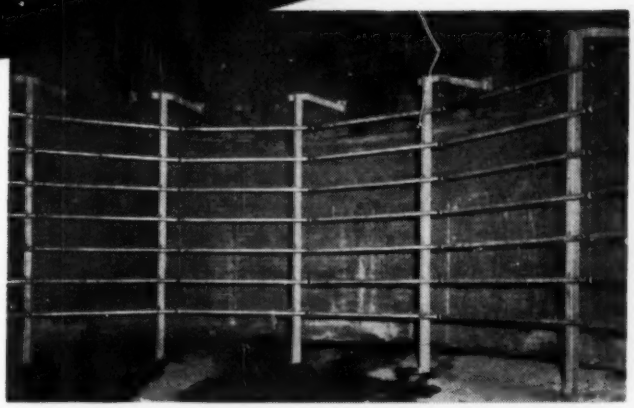


In this new Sewage Treatment Plant

BYERS WROUGHT IRON PIPE helps avoid maintenance



TYPICAL WROUGHT IRON DIGESTER COIL INSTALLATION

When Thomasville, Georgia, constructed a new sewage treatment plant, the sound policy of building for permanence was followed. Severe corrosion was rightly anticipated in water and gas lines, and digester coil piping. To forestall excessive repairs and maintenance, Weideman & Singleton, the engineers, specified a time-tried material . . . wrought iron. Byers Wrought Iron pipe was used.

Digester coils are perhaps the most corrosive service in a treatment plant, as the normally aggressive character of the sewage is increased by elevated temperatures. Gas lines, also, are ranked by authorities as among the most punishing applications. The fact that wrought iron has been used in so many of the largest, most modern plants built during the past decade is an excellent indication of the confidence that engineers feel in the material. This confidence has been earned by wrought iron's excellent service.

There is no mystery as to why wrought iron serves so well in these punishing services. Its unusual corrosion resistance comes directly from its unusual composition and structure. Tiny fibers of glass-like silicate slag, 200,000 or more to the square inch of section, are threaded through the main body of high-purity iron. These fibers halt and diffuse corrosive attack, and so discourage pitting. They also anchor the initial protective scale, which acts as a shield for the underlying metal.

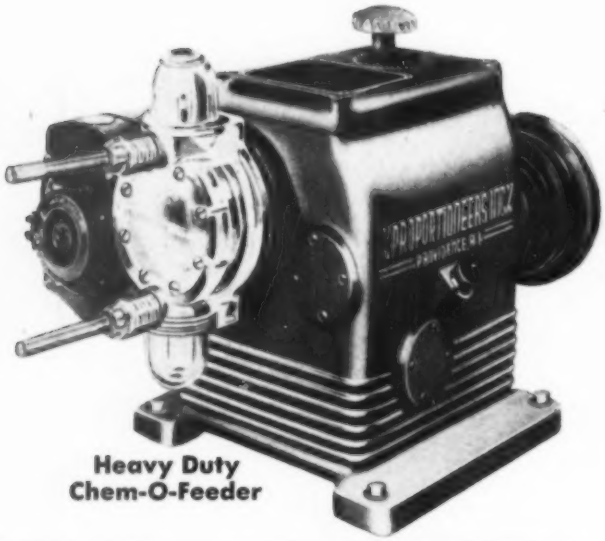
If you are concerned with the construction of a new sewage treatment plant, or the maintenance of an old one, you will find some helpful information on how to reduce repairs and maintenance in our bulletin, "Wrought Iron for Sewage Treatment and Disposal Installations." May we send you a complimentary copy?

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Seattle, San Francisco.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

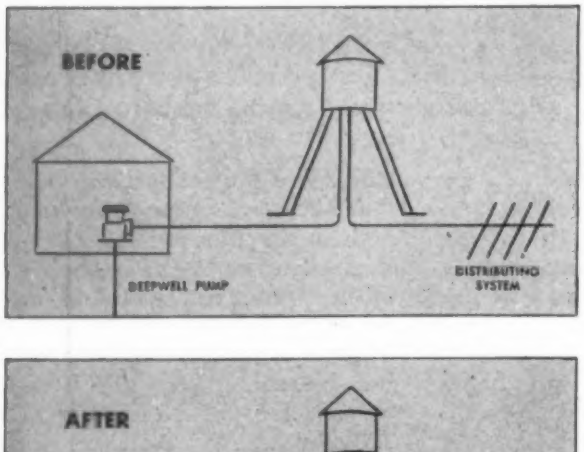
Hmmmmmmmm?

PROBLEM: **Purification of deep well water supply subject to periodic contamination by seepage through casing. Water is pumped intermittently (12 hrs. daily) to standpipe at 250 gpm with 65 lbs./sq. in. pressure at proposed treatment point.**



Heavy Duty
Chem-O-Feeder

SOLUTION: Install %Proportioneers% Heavy Duty Chem-O-Feeder with drive motor cross-connected to starting switch of well pump motor. Fill 55 gal. hypochlorite solution tank and use Taylor Enslow Slide Chlorimeter for chlorine residual tests. Chem-O-Feeder, set at 3 scale divisions and middle stroking rate, injects 0.5% Hypochlorite solution made up by dissolving 3 lbs. 2 oz. calcium hypochlorite or 7 qts. 12½% sodium hypochlorite in tank full of water. Equipment is simple, dependable.



RESULT: Automatic sterilization of water (½ ppm dosage) in step with well pump. Only attention required is periodic chlorine residual test and refilling hypo tank every 4 days. No lethal gas — no danger.

CONCLUSION: Your problem may be different, but %Proportioneers%, with experience acquired in more than 20,000 installations, has probably met and already solved your problem. Recommendation and quotation cost you nothing. Let us help you. Send us details of your problem.

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COMING!

Developments of the Year in the Sewage and Industrial Waste Field

Comprises the Annual Review regularly featured in the February number of *Water & Sewage Works*. For the year 1946 the review is being developed by the President of the Federation of Sewage Works Associations, a writer of top ability at factual reporting and commenting in a lucid and interesting style—

FRANCIS S. FRIEL, Cons. Engr.,
Albright and Friel, Engrs., Philadelphia, Pa.

The ABC's of Depreciation

Is just what the title signifies and is applied to water utility properties. Those of our readers who are familiar with the earlier lucid presentations of the author of this discussion of a highly important phase of water works economics and financing will be watching for this valuable contribution and reference article by—

JOHN H. MURDOCH,* Attorney,
Am. Water Wks. & Elec. Co., New York.
(*President of the Pa. Water Wks. Ass'n.)

50 Years of Progress in Centrifugal Pumping of Water and Sewage

Is an interesting review highlighting the more important stages in the evolution of centrifugal pump design and performance betterments over the half century to the present stage of perfection in centrifugal pumping. Presented before the Pa. Water Works Assn's. 50th Anniversary Meeting, this review is the contribution of—

H. GARTMAN, Actg. Chief Engr.,
The DeLaval Pump Co., Trenton, N. J.

Water Rates vs. Power Rates and Public Demand

Are discussed in an interesting article which reveals the possibilities of furnishing water during off-peak periods at reduced rates—a parallel to power company practices. The author tells of the results of a program of developing increased water sales through turning from water producers alone to "water salesmen" as well. In this story is a nice insight into the development of better public relations along with the business of getting in more revenue for the municipally-operated water utility. The author, whom all Spartanburg bets on, is—

R. B. ("Bob") SIMMS, Supt.,
Water and Sewage Works, Spartanburg, S. C.

Filter Bed Cleaning Experiences

Will be told by a plant superintendent who has successfully employed the application of Sulphur Dioxide (SO_2) in cleaning the encrusted sand in water filters. Details of the process and results will be given by—

CLYDE F. ANGLE, Water Supervisor,
Celanese Corp., Rome, Ga.

Gas Engine Maintenance and Operation

Is the story of ten years of successful operation of gas engines using sewage sludge gas at Peoria, Ill. This appraisal of gas engine performance and usefulness, with maintenance and operating experiences, is the contribution of—

L. S. KRAUS, Chief Chemist,
Sanitary District of Peoria, Ill.

"Shortage Engineering!"

We prefer not to divulge the contents of a paper carrying such a captivating title as "Shortage Engineering." If your curiosity is normal you will be watching for this story from "Shortage Engineer."—

H. W. POSTON, Asst. Supt. & Engr.,
Dept. of Water, Kansas City, Mo.

VOL. 94, NO. 1
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You can't stop RISING costs

BUT YOU CAN INCREASE REVENUE

by better meter repairs....

here's how you do it

This Manual, sent gratis to Water Works operators, contains a wealth of factual data on modern meter shop practice in planning efficient shops, and testing and repairing water meters. A copy will gladly be sent to you upon request. Get this Manual, study its shop-plans, its work sheets, its record cards, its photos . . . and learn how to increase your water revenue.

Practice proves that properly tested and repaired water meters substantially decrease unaccounted-for water — with consequent increase in revenue. The under-registration of meters, especially on low flows, is the real "revenue thief"; and repairing meters to catch the small flows pays impressive dividends. How true this is you can readily see, when you consider that 25% of all water flows through domestic meters at 1 gpm or less — and between 11 and 16% at under ½ gpm. Here then, is your way to balance increased production costs with sales . . . consult your Trident Representative for further helpful advice on a testing and repair program.

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WATER & SEWAGE WORKS

VOL. 94, No. 1 JANUARY, 1947

A Gillette Publication

A WATER WORKS EXECUTIVE'S VIEWS OF 1946

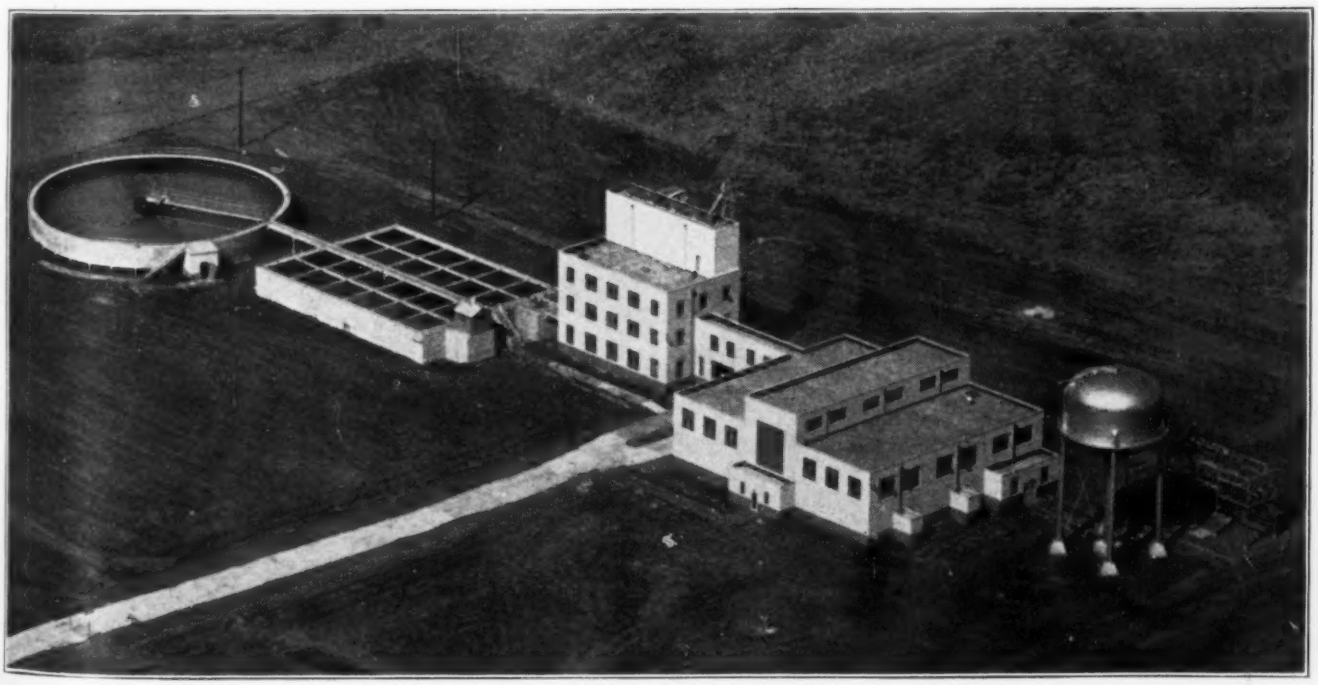
Developments of the Year in Retrospect – And Something of the Future

By WENDELL R. LaDUE
Superintendent and Chief Engineer
BUREAU OF WATER AND SEWERAGE
AKRON, OHIO
(President of the American Water Works Assn.)

THE year 1946 in the water works field has been one of stocktaking, including the inevitable self-analysis attendant to the let-down resulting from four strenuous years of war. A respite (synthetic as it may be) has made it possible for the executive to look around and appraise his personnel, his stock, and his plant, much as the football coach does on Monday following the stirring battle of the Saturday previous. He notes his mistakes, his weaknesses, his losses, his gains, and learns to treat his headaches with philosophical introspection.

The Author

While the war was in progress it was believed that a temporary economic depressive condition would develop in this country during the readjustment period immediately following the cessation of the fighting in Europe and in the Pacific. It was anticipated, and we were of a mind that to help in preventing economic instability during this critical period it would be up to political subdivisions to start construction work as quickly as possible after the fighting stopped. This was the basis of the philosophy behind the "Blue Print Now!" program (shall we



One of Those Rarities of 1946—Oklahoma City's New Softening and Filtration Plant

say propaganda?) of the late war years as a jointly executed enterprise of water and sewage works associations of America.

So, largely as a result of the "Blue Print Now!" movement, plans for large construction programs are ready, and their conversion into construction contracts awaits only a much-to-be-desired freedom from strikes, a desire to work, stabilization of material prices and wage scales, and an assurance of reasonable delivery schedules for materials and equipment. By October 15, 1946, the F. W. A. had issued loans for plans to 1502 communities for 1796 water and sewage projects. By the use of "escalator clauses" a certain amount of "post-war" planned construction is being placed under contract. Such "escalator" clauses also enable the scheduling of material contracts to insure position on production schedules months in advance. Wise water works men are now scheduling such contracts for even late 1947 deliveries.

Construction Prospects and Replacement Problems

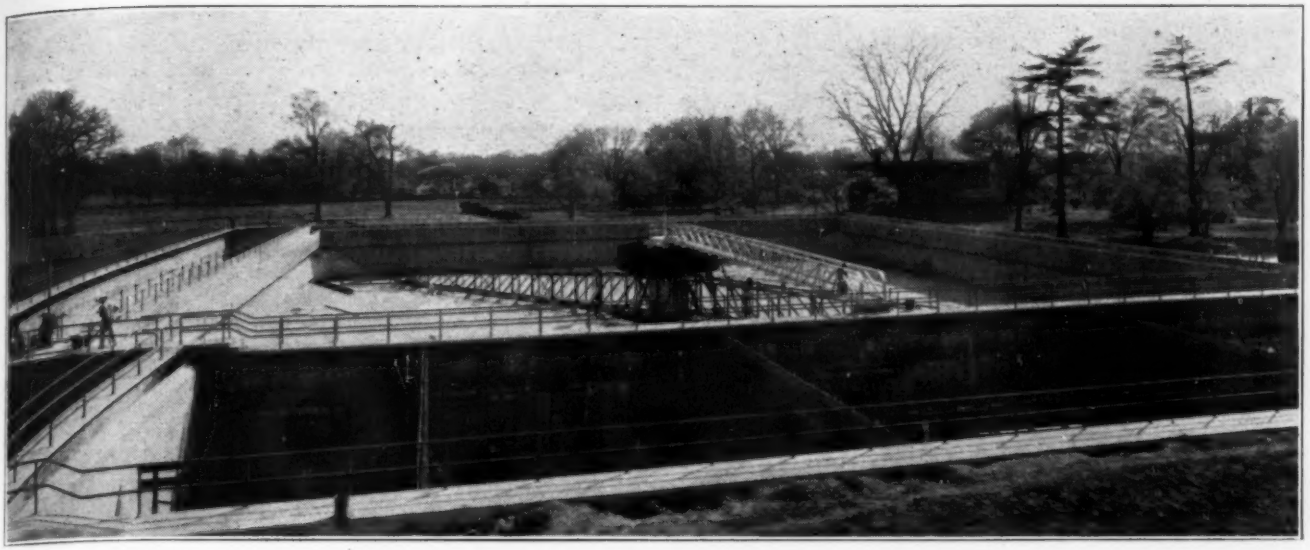
Now, 16 months after V-J day we see that the anticipated depressive crisis failed to develop. On the other hand, a potential booming crisis is in the making, which, in the water works field, may be considered capable of producing more serious consequences than the predicted depressive crisis. Increased home building (long-deferred) to provide homes for returning veterans and their families and increased commercial building by companies improving their physical capital position from surpluses are the signals of this booming crisis. All this has proved a disadvantage to the characteristically, steady, long-time development generally associated with the water works industry. During the war years, water works operations held top civilian priority. With the removal of War Production Board provisions and aid, water works have had to compete in the open market with all business alike for available materials and labor. The result has been a slowing down to a practical standstill of plant construction so necessary to provide for the strangely persistent increased demand for water. The same is true in the procurement of materials for vital replacements too long delayed by the war activities, to which the water works industry devoted itself so whole-heartedly. Many cities, already accustomed to war peaks of water consumption at 50 per cent or more above pre-war figures witness still further demands and increases in consumption rates.

In the materials field, "promised" delivery dates of vital water works distribution system items are upward of six months, which is of little help to the returning veteran who wants a home NOW. War workers, having become accustomed to the niceties of previously unknown conveniences, are loathe to return to their former homes. The veteran, returning, finds his home town crowded with new faces. Both groups compete for facilities, as yet unavailable. Discouraging strikes disrupt orderly processions of goods, retard deliveries, upset schedules, and reduce production.

Reduced inventories have caused many to hope for replenishment of stock and equipment from government war surplus only to find many disappointments due to changes in the method of releasing and the fixing of priorities. On the other hand, some fortunate individual works have been substantially aided through aggressive, alert management. Sale of surplus pipe and accessories, in the ground on abandoned government projects, has not met with ready approval of the ever-practical water works executive. Trading of materials and supplies among water utilities is one of the finer evidences of respect, esteem and good-will among water works men, resulting to a major extent through acquaintanceship developed in such beneficial organiza-

Another of Those Rarities of 1946

Roanoke, Va.'s, new 6 MGD. Filtration Plant was nearing completion at the close of the year.



A Revamping Job for Louisville, Ky.
To raise plant capacity Dorrco Flocculators and Clarifiers were installed.

tions as the American Water Works Association. Water works men definitely know and anticipate their needs but have no control over expediting deliveries of vitally needed replacements.

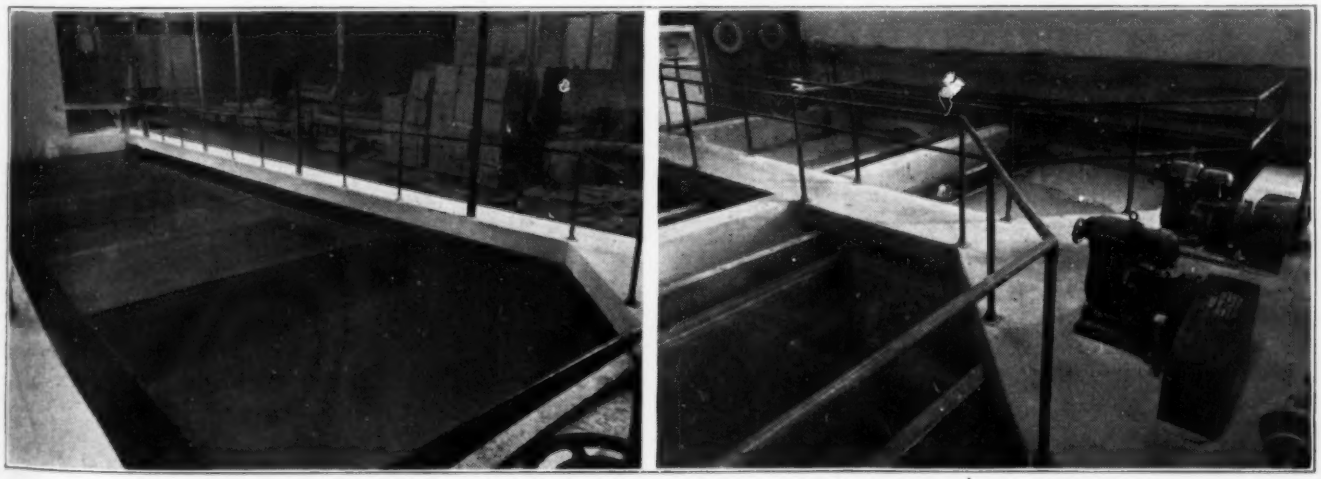
The ingenuity of the water works man is highly commendable in his efforts to combat such unforeseen and unprecedented problems. Under such circumstances the transfer of Arthur Gorman from W. P. B., where he performed a praiseworthy service to the water supply industry, into the field of federal housing was hailed with considerable relief by those who knew of his keen interest in, and knowledge of, water works requirements.

In spite of this apparent static condition, considerable work is underway in the water works field partially in picking up the loose ends of war, in completing some pre-war expansion projects, and in the doing of a large amount of routine construction, no item of which appears spectacular or extensive but, in the nation as a whole, adds up to a considerable amount. Peak demands have uncovered weaknesses and problems in deferred maintenance. In fact, many water works men are seriously concerned about their continued ability to keep abreast of maintenance requirements and increasing demands in an old plant already taxed to capacity.

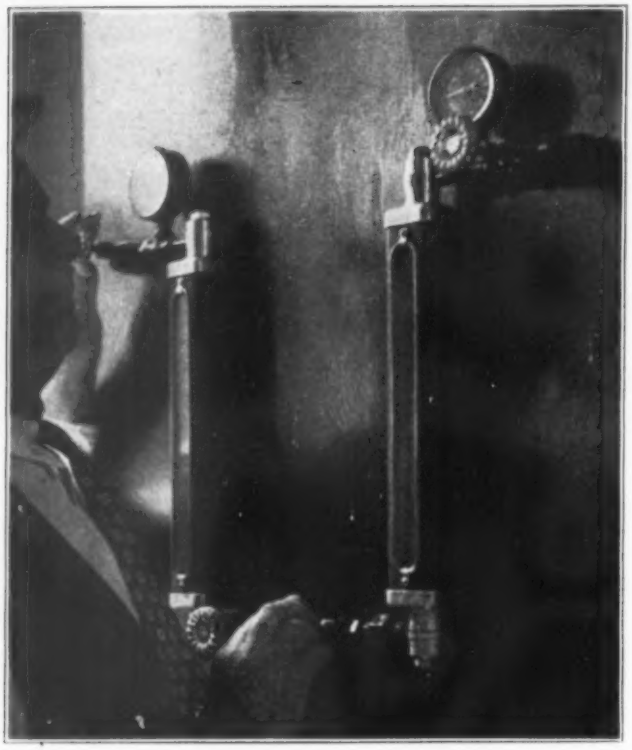
Personnel Problems

Water works, especially those municipally owned, are seriously handicapped in obtaining labor for either operation or construction activities. In the majority of localities the fixed schedule of wages is considerably below that of wages paid in industry and commercial construction in the community. We must admit that our type of work is largely physical and often considered menial. For this reason, in addition to the low wage situation in the water supply field, our work is unattractive to the returning veteran to whom we must look for replenishing the generally depleted and ofttimes over-age war-time personnel of the water works industry.

The almost universal country-wide consideration and adoption of retirement systems introduces a management problem wherein key men of valued experience and unquestioned loyalty are being retired, often involuntarily. This may leave serious gaps in many a well-balanced organization due to the past inability to secure promising understudies during years of high pay to war industry employees, and service of the younger men in the armed forces. Yet retirement, with partial pay, is a real step forward in human relationships. Here



Another Revamping Job of 1946
In which the capacity of the Fairmont, Minn., Softening Plant was more than doubled through modernization, consisting of installation of "Rex" Floctrol units (right) and conversion of old style settling basins to "Rex" Verti-flo multi-cell units. Result—30 to 40 hr. filter runs increased to 100 hrs. or better.



Sulphur Dioxide Dechlorination Control Rotameters at the Richmond, Va. Plant
In use for some time at Richmond, other plants have adopted this exact residual free chlorine control method during the year.

the water works profession proves it is vitally aware of a weakness of the industry in the human field of public and personnel relationship as distinguished from the field of safe, healthy and economical construction and operation of the physical plant under its care.

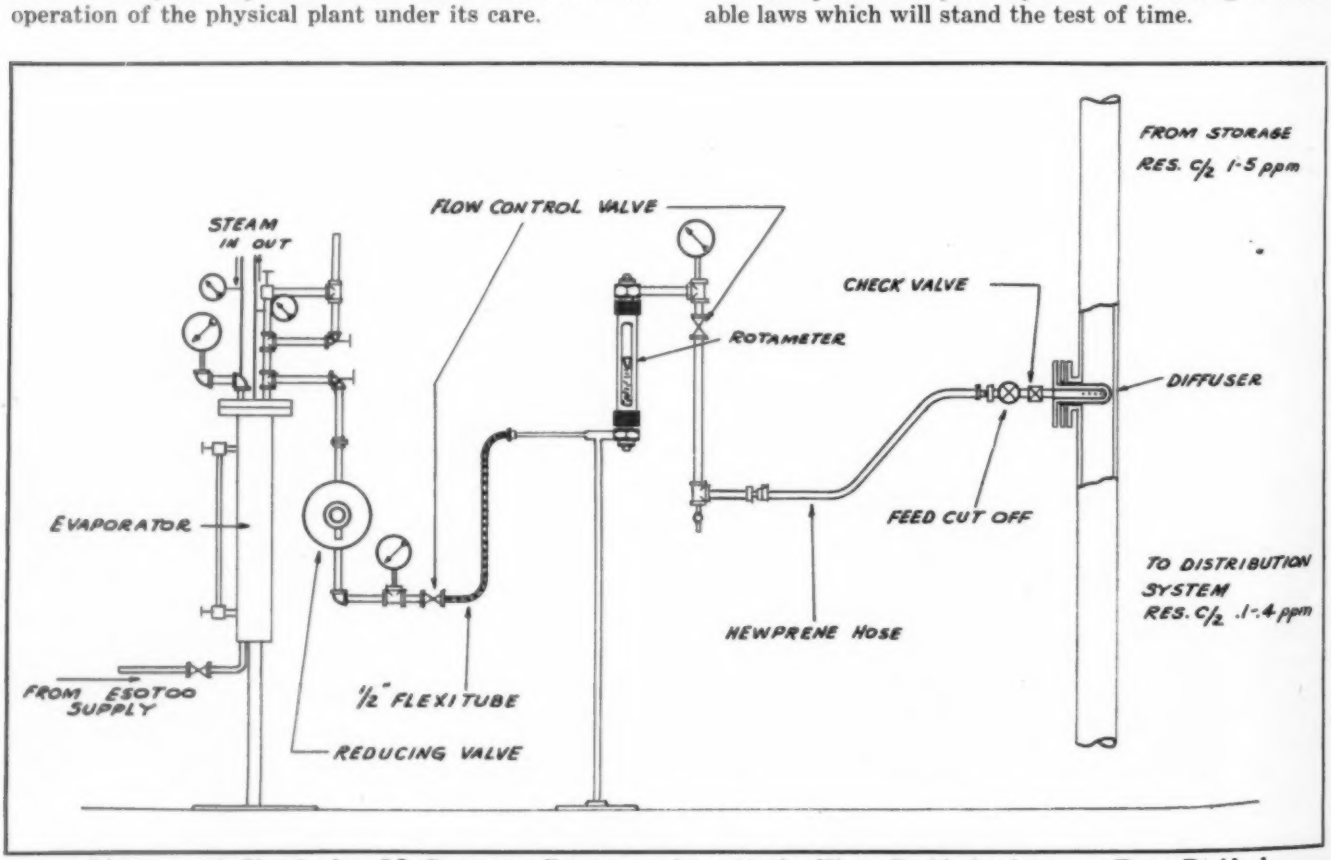
A LOOK AT 1946

Then, just what does the executive see in his 1946 stock-taking survey?

Surface Water Supplies

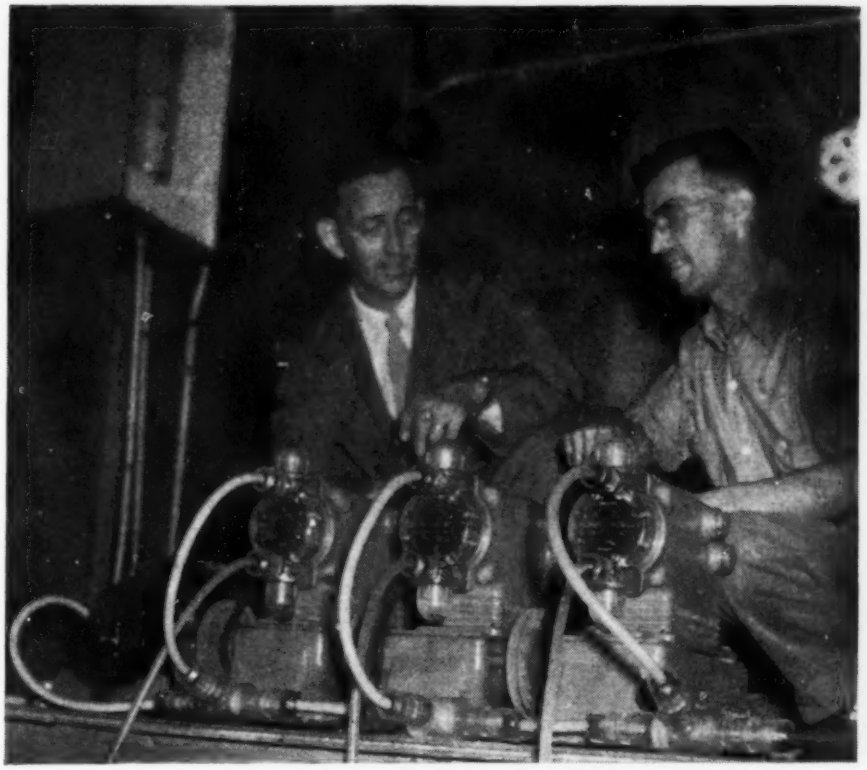
Looking at his source of material (water) he finds, if his is a surface supply, a "growing" interest in reforestation, perhaps as much for the general national good as for the betterment of his water supply. The water works executive is indeed fortunately situated to replenish the depleted timber supply which, during the war years, was so very essential and critical to victory. In the home construction problems of the reconversion era it is and will remain a critical asset. The problem and its solution is being vigorously attacked by water works executives, notably in New Haven, New York, Akron, and Seattle and in smaller cities, especially in New Jersey. The United States Department of Agriculture is taking an aggressive interest in reforestation studies. This is not a passing fancy but an effort in the interest of national betterment. The controlled use of reservoir and surplus lands is receiving renewed emphasis in seeking to supply needed recreation areas, increased food supply and other benefits in addition to Christmas tree and lumber production.

Again there is an awakening to the need of correcting the pollution problems of our rivers and lakes. The purification plant operator is doing an excellent job, but the load being placed upon him is becoming too great. War-time emphasis on production left little time to care for waste products. Several states have recently passed anti-pollution laws with teeth to compel compliance. Federal legislation in 1945 and 1946 did not materialize since it left much to be desired in the direction of providing for effective cooperation. The A. W. W. A. is alert to new legislative developments with an eye to view the problem objectively and the securing of workable laws which will stand the test of time.



Diagrammatic Sketch of an SO_2 Rotameter-Evaporator Assembly for Water Dechlorination to an Exact Residual
(Sketch by courtesy of Virginia Smelting Co., of West Norfolk, Va., suppliers of "Essotoo.")

Water treatment men, characteristically, continue to furnish a satisfactory, safe potable water regardless of the raw material furnished them. This is becoming more difficult each year but hoped-for legislation regarding anti-pollution of streams and use of ground water basins will aid in their problem. A new thought of utilizing used wash water and effluent of sewage plants under certain conditions, however, add to their problem. This is particularly true in the industrial field.



Chlorine Dioxide Producing Assembly for the Smaller Plants

At Jamestown, R. I., Chem-O-Feeders automatically proportion High-Test Hypochlorite, Acid and Sodium Chlorite solutions to produce ClO_2.

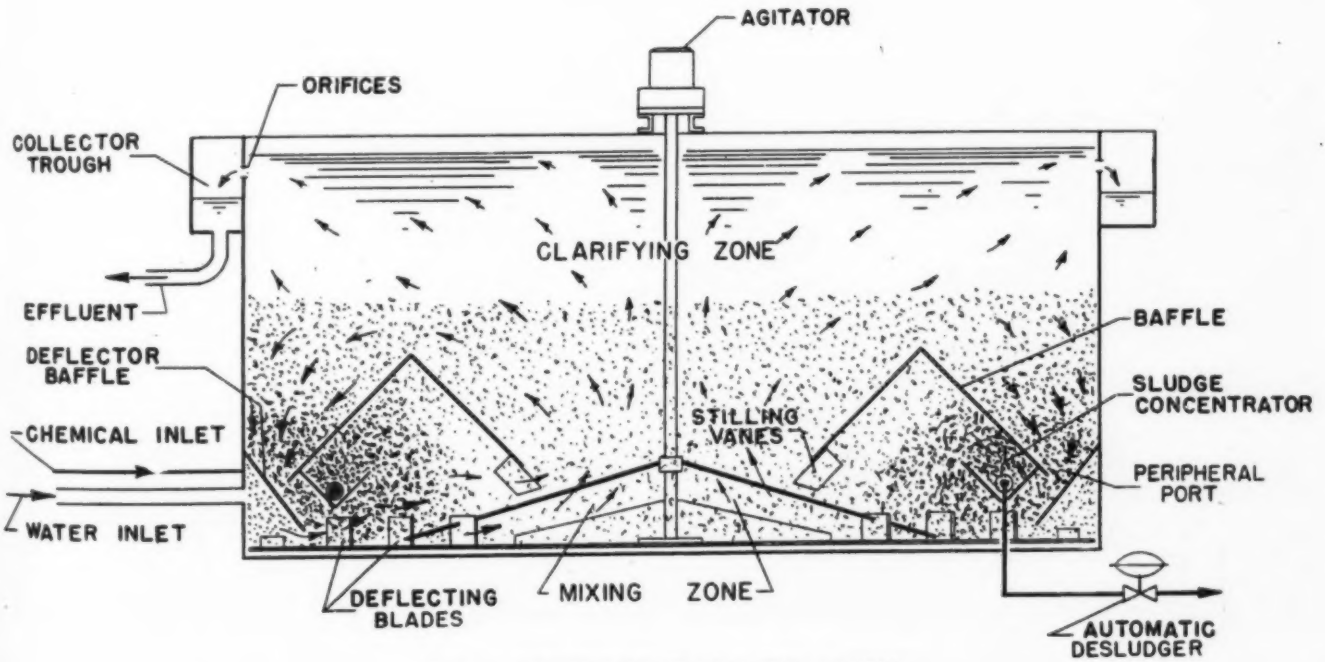
Ground Water Supplies

If the executive be a ground-water man, the continued heavy demand on his supply, either by himself or by industry developing the same field, has caused consternation. Unlimited use of ground-water is rapidly developing laws involving state control. If he be a coastal man, the encroachment of salt water into his well-field is a major problem which must be combatted at all points if the water supply is to survive. Unbridled and unlimited use in many Florida and California areas is viewed with alarm and will result in corrective legislation. A rational development, however, may be seen emerging from the crisis. Ground-water "use" legislation; well drilling codes and studies of well field recharging, either by diverted surface water supplies or properly treated and controlled "used water," all point to a better understanding and solution of the problem.

Treatment and Control

Continued study of the use of chlorine in the treatment plant has developed several new conceptions concerning "breakpoint" chlorination which has more recently come to be known as "free residual" chlorination as contrasted to "combined residual" chlorination. The determination of the types of chlorine residuals by an elimination process is an interesting and valuable contribution to water treatment chemistry.

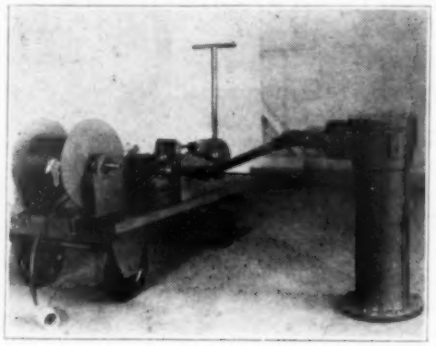
Further studies and experiments in the use of chlorine dioxide and heavy chlorination followed by reduction of



A New Softening-Clarification Unit of 1946

The "Liquon" Sludge-Contact Reactor, featuring mechanical slurry agitation and horizontal radial flow.

Northrup Waterworks Test Set *For Making Hydrant Flow, Pressure and Friction Tests.*



The Dean Electric Power Truck *For Valve and Gate Operation.*

New Equipment of 1946

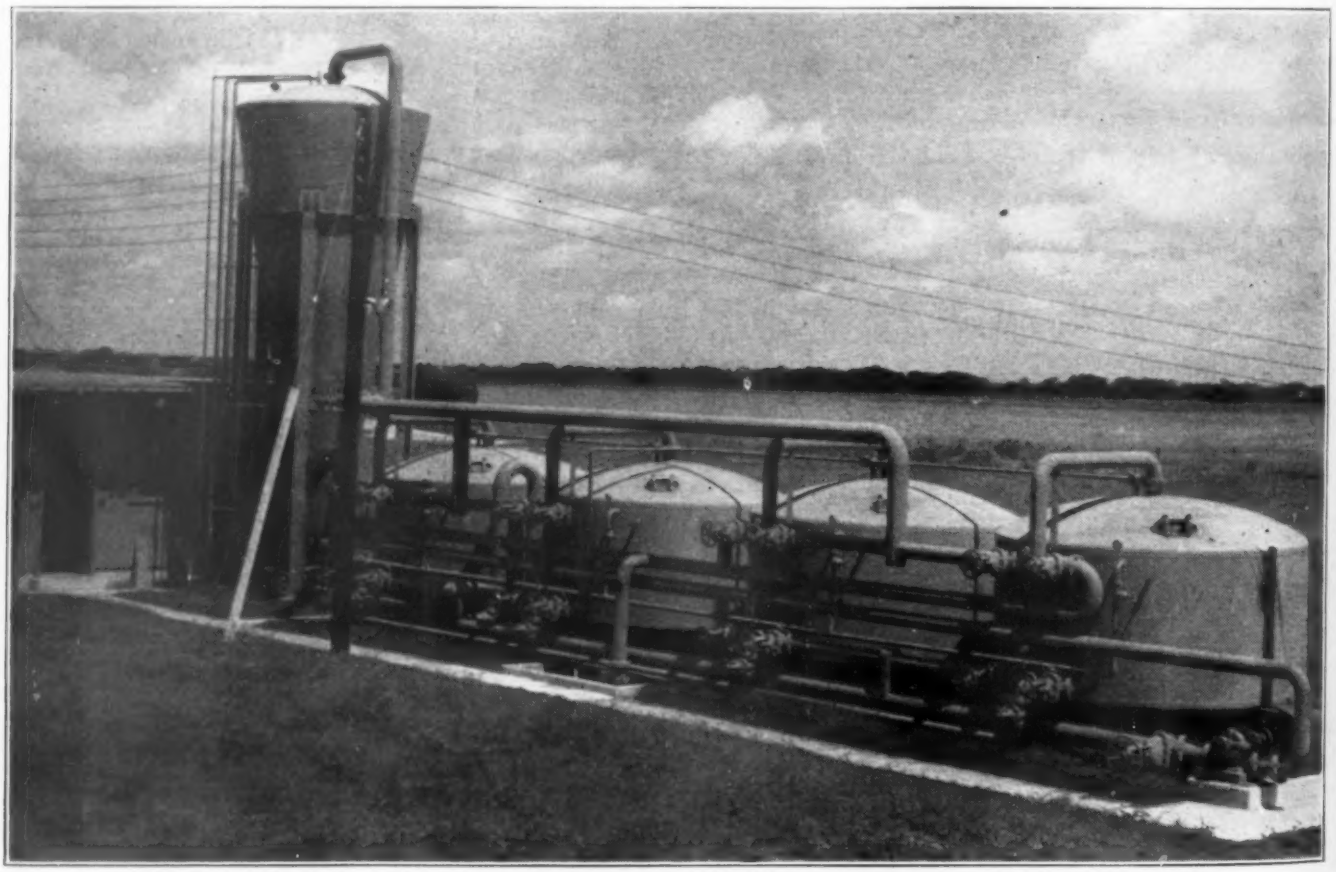
the "free residual" in whole or in part with liquid sulphur dioxide in taste control practice, as well as in preliminary raw water treatment, were outstanding. Fluorine additions for dental caries control were continued in city-wide experiments notably at Grand Rapids, Mich., and Newburgh, N. Y. Where manganese is present, the introduction of "free residual" chlorination again provides problems for the pumping station supervisor due to manganese depositions. A new worry for the treatment plant man is the appearance of an algae which will cause corrosion of metals in the system.

The regrowth of the demand that treatment plant operators (including shift men in the plant) be skilled and certified to high standards has tended to increase the present high standard of treatment plant personnel.

The mechanical developments of the war years are being transferred to the boiler plants and pumping stations of the water works in the form of increase of unit efficiency, compactness of construction and increased automatic control largely through improvement in the electrical and electronic field. Coal strikes are causing many executives to consider the security offered by the use of gas and oil in standby units.

Highways and Water Mains

The proposed construction of super-highways is producing many headaches for the water works man. Highway administrations too often look upon water facilities and other utilities as trespassers along rights-of-way and therefore accept no responsibility for the cost of changing these utilities when the highway is revamped or relocated. Sometimes little advance notice is given and too often the cost of such changes is more than the water utility can bear without wrecking its economic set-up. Likewise, the highway, real estate and social welfare interests have fostered the development of small acreage home sites along and adjacent to these new highways. Under present economic public utility financ-



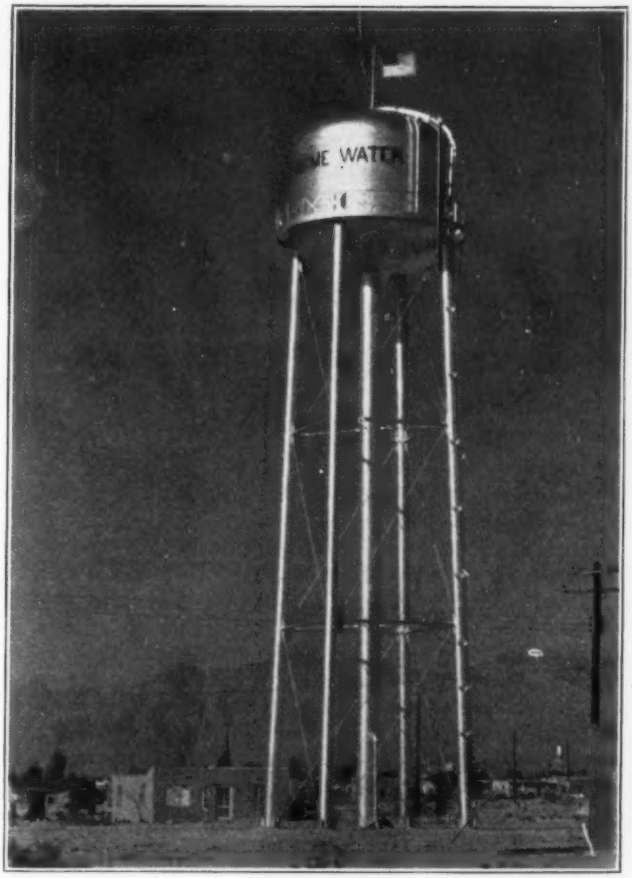
A "Spiractor" Softening Plant of 1946
Featuring the Permutit "Spiractor" (the conical vessel on left), these plants employ no flocculating or settling tanks. The resulting compactness of this all pressure type plant is plainly evident.

ing it is impossible to furnish these home sites with the safe, potable water and adequate fire protection which these citizens require. While Milwaukee continues to refuse municipal water service to industrial plants located beyond city limits, an Oklahoma court case is testing the obligation of a city to serve water beyond its borders. General administrative and legislative officials should give thought to these problems, looking toward the relief of the utility from some of these excessive burdens, or producing ways and means of deficit producing enterprises.

Water Rates and Meters

The water consumer is most actively interested in the efficiency and adequacy of the service and meter supplying him with water. The water executive must, therefore, be constantly on the alert to keep abreast in this field. During 1946 he has seen increased interest in, and objective thinking toward, the proper sizing of services. He hopes for a possible reduction in cost of service construction or at least a holding to present expense in the face of rising labor and material costs. Likewise, the proper sizing of meters and the increased interest exhibited in testing and maintenance of meters are evidence of the executive's interest in increasing revenue from an existing plant as a weapon to combat costs rising to a point higher than income. As L. R. Howson brought out in his highly important paper* before the American Water Works Assn. at St. Louis in May of 1946, water works executives must be alert to their responsibility to maintain service, to make improvements as needed, and to adjust their rates so as to provide the funds necessary for the needed expansion as well as operation and maintenance. In many cities

*Reprinted in the June, 1946, issue of *Water & Sewage Works.*



Lucky Home Water Co. of Tucson, Ariz.
Secured in new all welded stream-lined 50,000 *gal. tank in* 1946.

The New Clayton Pump and Surge Control Valves
A companion development to Clayton's Unique Modulating Float Valves for control of pump delivery to meet fluctuating water levels.

the revision of rate structures upward to meet changing conditions is inevitable and must be faced courageously.

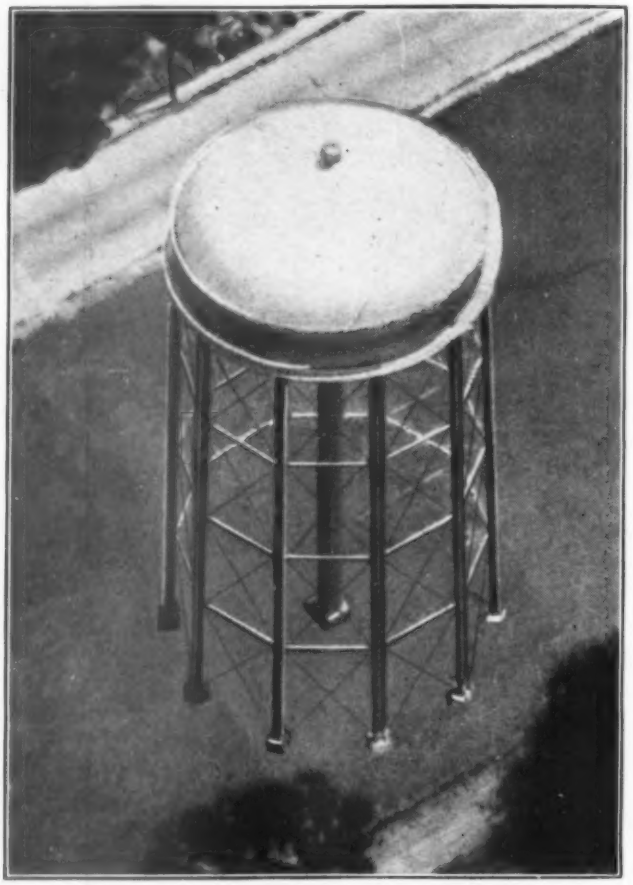
Equipment and Materials

During the war years, water works executives adopted many new methods and materials in order to participate in the all out effort of winning the war. Ofttimes substandard methods were deemed expedient and necessary. Each executive is now reviewing those methods and materials which he introduced into his system and is deciding whether they should be retained as standard practice; considered as a war necessity and their use discontinued; or whether they should be replaced as soon as practicable in the interest of good management. The dropping of brass and copper substitutes is noticeably evident.

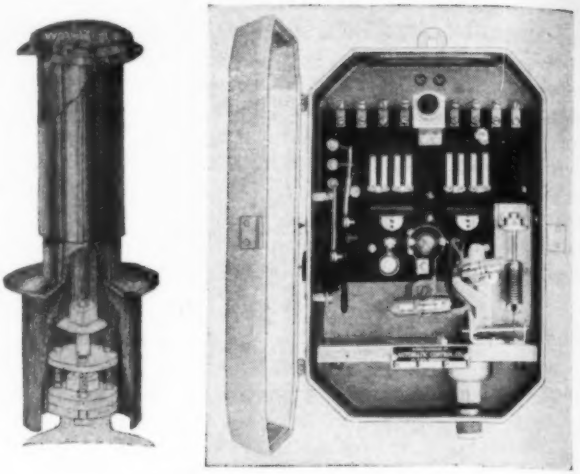
Among the new items of water works material and equipment developed during 1946, mention may be made of the following:

A valve actuator put on the market by the Bendix Aviation Corporation is of simple construction. A small reversible electric motor drives an oil pump in either direction and provides oil under pressure for operation of the valve. When the valve seats the pressure is built up, thus pressure-sealing the valve. If for any reason the pressure drops, it is automatically and immediately re-established.

The Clayton Manufacturing Company, Alhambra, Calif., has developed an automatic and fully hydraulic operated pump control valve which protects both pipe and pump from surges when starting and stopping pumps. Reported tests on the use of these valves during 1946 indicate that positive starting surges of 55 psi. were reduced to 5 psi. and that negative surges on shutting down of pumps which amounted to 65 psi. without the valves were but 7 psi. after the valves were installed.



Washington Suburban Sanitary District's Trim New 500,000 Gal. Tank of Toroidal Bottom Design



Introduced in 1946

(Left) The steel plate two piece "Duro" Adjustable Valve Box by Lee Hydraulic Co. of Troy, N. Y. (Right) The deep well pump "Protectrol" unit by Automatic Control Co. of St. Paul, Minn.

Payne Dean & Co. have adapted their valve operating equipment to a hand drawn truck for operation around a station. Operating mechanism is either electric or gasoline-driven.

Many new plastic materials have been developed which have good bond to metals, resistance to abrasion and to conditions of exposure common to water works operation. The surface must be clean when the coating is applied. After evaporation of the carrier, the coating must be properly baked. Portable heating devices making use of infra-red reflecting lamps may offer the answer for plant and field use.

Silicones, a family of materials, has been developed for high and low temperature use. It is said that motors insulated with silicone products will operate safely at 350° F. Silicone greases which will dependably lubricate motors at this temperature are also serviceable at –40° F.

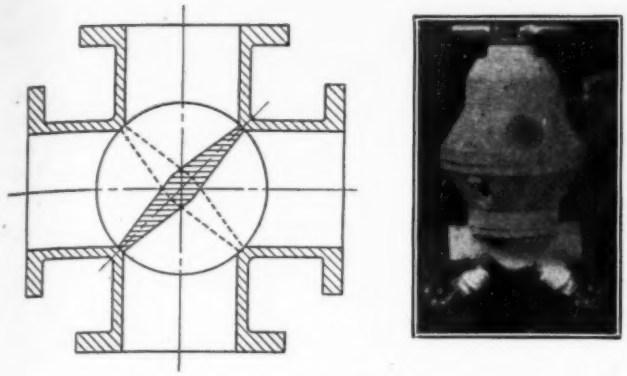
Radio communication systems developed to a point where many cities rely upon such devices for routine work as well as emergency calls. This is particularly true where the supply is quite distant from the point of use. Local conditions usually determine the advisability of joint operation with either police, fire, or state patrol facilities.

The cleaning of mains and lining with cement mortar in place, particularly of large supply and distribution lines, has progressed rapidly as a means of increasing capacity while preventing subsequent corrosion and prolonging useful life. Some of the results obtained are worthy of careful study by those executives faced with supply problems in this period of materials scarcity.

Numerous items of treatment plant testing and control equipment utilizing the rapid advancement in the plastic and electronic field during the war years have been developed, and forecast for the coming years even more efficient operation of the water works utility.

Safety

There are many other points to be considered in this stock-taking. The question of safety of the plant structure itself and of the personnel is now accepted practice. Safety campaigns, while often routine, are nevertheless worthy efforts. In this connection may be mentioned the question of electrical grounding, a subject on which



Introduced in 1946

(Left) The Four-Way Transfer Valve of R-S Products Corp. of Philadelphia. (Right) The new "Micromet" Feeder by Calgon of Pittsburgh for household feeding of the low soluble meta-phosphate to correct corrosion or encrustation problems on the individual premises.

the water works and electrical men are still far apart in spite of an aggressive attitude on the part of the A. W. W. A. Another item of safety is good housekeeping and its attendant benefits in pride of ownership and faultless custody. There are many instances of excellent housekeeping, one of which at Lancaster, Pa., has been particularly noticeable to the writer. I would hesitate to mention more for fear of leaving out many excellent examples.

Close cooperation between water and fire-fighting executives is essential. Each has endeavored more and more to see the other's point of view. This can be done locally by the water executive contacting the fire chief and discussing their mutual problems, especially *after* a fire. Firemen have been asked to participate in the meetings of water works men, as was the case in Ohio and certain New England states. The O. C. D. did much to promote a spirit of cooperation between these two vital branches of public safety and this spirit has been fostered in many of the meetings of Sections of the A. W. W. A.

In order to carry out extensive capital improvement successfully, bond financing must be undertaken. The successful executive has given careful thought to the question of revenue vs. general obligation bonds in planning his future expansion. He would do well to be on the lookout for changes in the basic laws of his state on this subject, which proved a live topic in local section conferences.

National Water Standards

Another development in safety is the 1946 Standard of Water Quality issued by the U. S. Public Health Service for water used on interstate carriers. The tentative Standard and the Manual of Water Sanitation Practice prepared by the U. S. P. H. S. for water works plants were thoroughly discussed by the U. S. P. H. S. and the A W. W. A. At its January 1946 meeting the Board of Directors of the A. W. W. A. voted acceptance of the U. S. P. H. S. 1946 Standard and advocated it as the National Standard for all public water supplies. This is a milestone in water supply history.

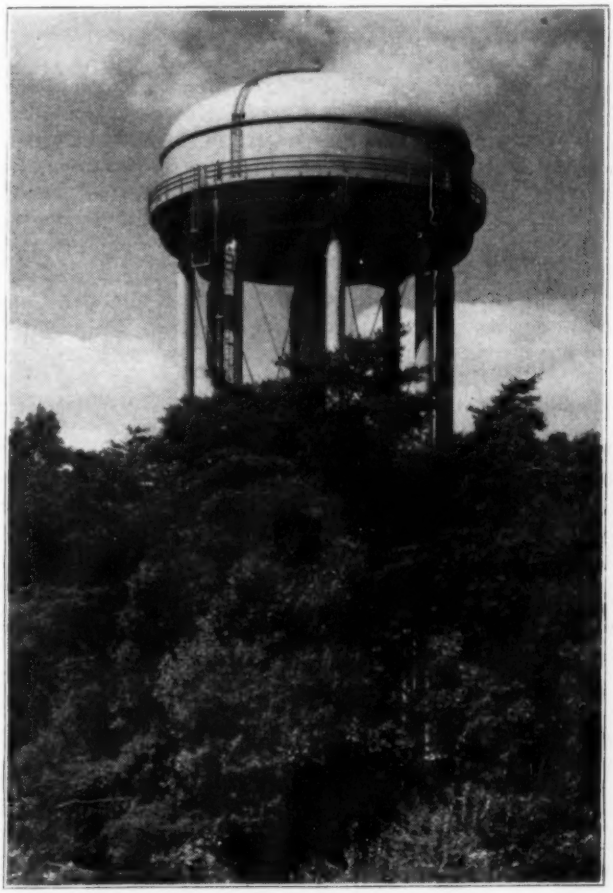
Public Relations and Management

Management, Personnel Relations, and Public Relations loom large in the 1946 survey.

In the field of management there emerged the first report of the A. W. W. A. Committee on Water Works Management of which the writer is Chairman. This report was the result of several years' study during the trying war years by some 25 members vitally interested in promoting better water works management. Management problems can be solved only at the local level. Organizations like the A. W. W. A. can only assemble data and point the way for the individual to follow. Good management can be helped by an exchange of ideas and honest endeavor to learn what the other fellow is doing. This has been fostered by an exchange of annual reports in which all, however, should talk the same language. For instance, what is "unaccounted for" (or should it be "unrecorded"?) flow; should mgd. or cfs. be used for reservoir yield, etc.? The A. W. W. A. has appointed a committee to point the way to executives in preparing annual reports. Much good can result.

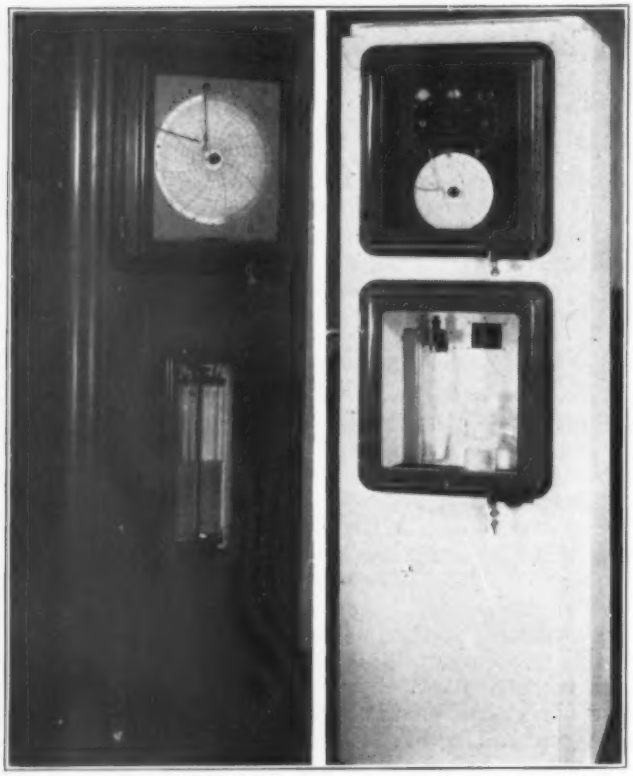
Personnel in the water works field has in almost every instance upheld its tradition of loyalty to management during this year of strikes and labor unrest. A water works job is a position of public trust. Water works management is recognizing its personnel more and more in the extension of retirement provisions, participation in surplus income (legalized in Wisconsin) and in the working of Public Law No. 679 concerning G. I. on the job training.

The idea of good "Public Relations" has been uppermost in the water works executive's mind during the past year. It has appeared to him on the written pages of the various journals, he has heard it at the various conferences (at the 1946 A. W. W. A. Conference in over 50 per cent of the papers, the psychology of human relationship was uppermost in the authors' minds) and he had sensed it daily in his dealings with his consumers and with his business associates both in and out of the utility field. At AWWA's St. Louis Conference the



Something New in Tank Design

Macon, Ga's., new 500,000 gal. tank of 60 ft. diameter has an all-aluminum roof supported by aluminum alloy I-beams, also ladders and other details of aluminum.



Two of Wallace & Tiernan's Post-War Offerings
The Chlorine Flow Recorder and the Automatic Continuous Residual Chlorine Recorder for use at the plant or at various points on the system.

Public Relations Survey Committee made an excellent report—the result of conscientious and understanding effort. The Board of Directors assigned to the Executive Committee of A. W. W. A. the task of placing into effect the first step of a program which it is believed will eventually become its most important activity in over a decade. Periodic releases of public relations data, designed to aid water works executives of all grades, are now reaching the membership as printing difficulties will permit. The whole-hearted cooperation of water works men is apparent.

Of one thing all thinking water works men are aware —namely, the need to publicize the water works man and his efforts in upholding the status of this most essential public function. The question then arises, "How Can This Be Done?" and, more personally, "What Can I Do About It?"

What are the phases of the human element of a water utility which will influence and control the degree of good Public Relations which a given utility will deserve and receive?

1. *Water Works Organization.* This should be clean cut and in general divorced from the short term political policy of the municipality. The top man should have the opportunity to exercise his trained capacity to function without outside mediocre control.

2. *Personnel Relations* within the utility must be such that each employee understands his special niche and function in the organization, with the assurance that his initiative and acceptance of responsibility will be recognized. He must have fair assurance of reasonable continuity of service at an equitable wage with provision for retirement benefits.

3. *Public Relations* with the general public cannot be upon a high plane unless the two foregoing phases of the human element in the industry are of the highest attainable. Each and every man in the utility whether superintendent, meter reader, teller, or the laborer in the ditch contributes to or subtracts from the total amount of Good Public Relations. Good Public Relations can but be accomplished through local contacts, either with individuals or groups. Association activities prepare the foundation, point the way, and fix the objective.

The desire for closer contacts with other water works men and greater cooperation among the men in the utility is illustrated by the growth of the A. W. W. A. During the war period when the idea of cooperation was at a high level, the membership rose from 4177 on January 1, 1942, to 5738 on January 1, 1946, an increase of 1561 or 37.4 per cent during the four years. To November 30, 1946, there had been a further increase of 623 or 9.8 per cent. With the cessation of war and the withdrawal of restrictions upon free movements, the pent-up desire for water works conferences manifested itself to a gratifying degree. Local sections clamored for conference dates, programs were prepared and, with attendance assured, conference after conference reported unprecedented interest, broken attendance records and scores of individuals requesting membership, affording participation in the benefits of the A. W. W. A. All in all, 1946 has proved an outstanding year in interest and enthusiasm.

After reviewing this 1946 survey let *Each* one consider what *He* can do to increase the prestige of the water works utility and to publicize its functions properly. Let us take nothing for granted. Let us view each accomplishment, not as the end of the road, but as a challenge to think ourselves *beyond* to greater achievement. Of such *new* thinking is progress made.

Clinton Inglee Passes

Clinton Inglee, President and General Manager of the National Water Main Cleaning Co., died at his home on Dec. 21 after a long illness.

"Clint" Inglee, as he was familiarly known throughout the American Water Works Assn., was a native of Amityville, L. I., where he spent his entire life. A graduate of Stevens Institute of Technology, Inglee entered the employ of the National Water Main Cleaning Co. in 1908 as an engineer. During his association with the company he rose to be secretary, treasurer, general manager and finally president.

Clint Inglee, sometimes called "the Golden Voice of A. W. W. A.," was active in the affairs of that organization and took a prominent part in the entertainment at most of the annual meetings, singing both solos and in a quartet. Mr. Inglee was also active in the Water and Sewage Works Manufacturers' Assn., having been President of that organization in 1938, and a director in 1938-42 and 1942-45.

Mr. Inglee was a member of other engineering societies; and held the presidency of the local school board for 20 years.

CATHODIC PROTECTION OF PIPE LINES

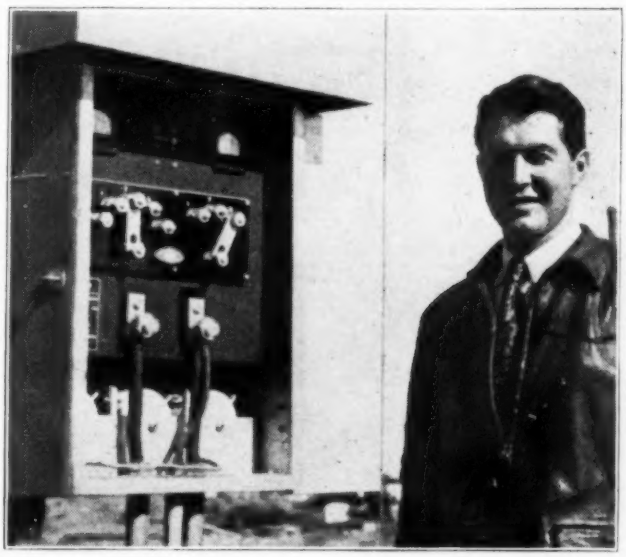
Maintenance History of the Bonita Pipe Line, Featuring Anode Renewals

by E. C. ROGNESS
Cathodic Protection Engineer
WATER DEPARTMENT
SAN DIEGO, CALIF.

THE Bonita steel pipe line was constructed in 1914 at a cost of approximately $220,000 and consists of 8.25 miles of 28 in. riveted steel pipe of ¼ in. wall thickness, provided with an asphalt dip coating. The pipe line was originally designed for a maximum capacity of about 8 mil. gal. a day.

During shutdowns a maximum static pressure in excess of 100 lb. per square inch may be experienced at low elevations.

Test data indicated the soils along the pipe line to be of a high to moderate conductivity. Inspections revealed a soil largely of a single type, distinguished by heavy compact subsoils.



The Author and a Typical Corrosion Eliminator Station

Maintenance History

Maintenance history on this pipe line discloses that leaks caused by corrosion necessitated the excavation of nine sections, aggregating a length of 1,674 feet where patches and sheath were welded around the pipe, all of which was encased in gunite, during the years 1927 and 1932. In 1940, 350 feet of this pipe line was uncovered, with corrosion areas repaired by the application of welded steel patches and covered with an asphalt. Again in 1940 and 1941, twelve sections totaling 1,803 feet were excavated and provided with a welded steel sheet encasement, protected with a coat of Barrett Water Works enamel. These repair sections were backfilled with sand.

Leak Data

The pipe leak data probably are characteristic of most steel water lines subject to corrosion. The data in the preceding paragraph and in the accompanying table will indicate the impressive functions of cathodic protection. The forced drainage inefficiency effect can very readily be observed.

Cathodic Protection System

A pipe line technologist was employed by the City of San Diego in September, 1939, to make a corrosion survey for the purpose of recommending corrective cathodic protection.

Year	Total New Leaks
1932	58
1933	87
1934	79
1935	99
1936	139
1937	152
1938	196
1939	220
1940	206
1941	167
1942*	94
1943	30
1944	13
1945**	45

*Major cathodic protection applied.
**Major anode failure period.

The system consists of 10 corrosion eliminator rectifier stations, with an estimated anode life of 20 years. The anode structure was composed of standard 6-in. second hand steel pipe welded throughout with the anode lead attached to one end. It was laid horizontally to a depth of 5 feet with 8 lengths of 500 feet and 2 lengths of 300 feet each. The table below provides station capacities with respect to pipe line station, station numbers, anode lengths and spacings from the pipe line cathode.

To provide good current distribution to a pipe line of low resistant coating, a minimum of 300 ft. anode distance from the pipe line feature was incorporated in the engineering design. A right of way problem resulted in only one exception to this optimum.

Installation Dates

A cathodic protection engineer was employed by the City of San Diego in 1941. Under his direction two station units were installed in July and November of 1941. The remaining eight installations were completed in 1942.

In November of 1942, during the war materials shortage era, an urgent need for a corrosion eliminator rectifier for the Otay-Second Main was felt. Testing indicated that cathodic protection could still be provided the 28 in. Bonita steel pipe line with cathodic station E inoperative. Consequently a loan was made of this rectifier, but it was replaced in April, 1945.

In 1943 the City's Cathodic Engineer was released to partake in war work.

Corrosion engineers from the San Diego Gas & Electric Co. assisted in

Station	Pipe Line Station	Rectifier Amperes	Rating Volts	Anode Length, ft.	Anode Distance from Cathode, ft.
A	51 + 92	75	16	500	582
B	105 + 50	100	16	500	815
C	166 + 00	50	16	300	300
D	208 + 55	100	8	500	350
E	230 + 00	50	8	300	595
F	253 + 63	100	16	500	300
G	276 + 43	100	8	500	250
H	317 + 43	100	16	500	310
I	378 + 44	100	16	500	300
J	417 + 11	75	16	500	300

analyzing causes contributing to an interruption of cathodic station F in January of 1944.

Anode Failures

This study revealed a severed anode for cathodic station F, due to foreign structure construction operations. It was immediately repaired. Again in November of 1944 another anode failure was experienced for the above station, due to a condition of localized cathodic current dissipation. Interrupted forced drainage service occurred at cathodic station C in November of 1944 and was again due to select area concentrated current dissipation. This anode break was subsequently repaired only to fail eight months later from the same cause. An alarming drop in corrosion eliminator output current in December of 1944 resulted in a physical inspection of the anode at cathodic station A and disclosed a section of about 20 feet to be near complete disintegration, thus affecting a great length of the anode fixture.

In September of 1945 the writer was employed by the Department of Water Development of the City of San Diego and his first assignment was the determination of causes for the alarming drop in cathodic protection efficiency.

Results of Investigation

With the aid of a low frequency pipe locator receiver, it was possible to establish the following conditions:

1. That a major portion of cathodic station A was inoperative.
2. That the anode for cathodic station B was severed at the anode junction tie point, leaving the northerly reach of 250 feet inoperative.
3. That the anode for cathodic station F was severed and provided only about 100 ft. of effective anode length.
4. That the anode for cathodic station G was broken at the anode cable tie point omitting the westerly reach of 250 ft.
5. That the anode for cathodic station H contained 350 ft. of effective anode length.
6. That cathodic station I was functioning with but 137 ft. of operative anode.

Conclusions & Recommendations

The history of these 10 cathodic station anodes had established a criterion that even the three systems which were then functioning according to their designed output would probably soon be in need of constant maintenance. The remaining seven cathodic protection stations were providing a very limited protection, a fact which apparently was conducive to a rise in the leak frequency. Increased water pressure resulting from the Otay Pumping Plant operation may also have been a contributing leak factor.

It was recommended that anode renewals be made for cathodic stations A, B, C, F, G, H and I as soon as possible. It was further recommended that these anode renewals incorporate the parallel conductor lead principle of construction and be installed as near as possible to the existing anode to facilitate the inclusion of the good sections of the original structure in the proposed renewal system. The operation of cathodic stations D, E and J should be observed closely in order that constant full cathodic protection would be afforded.

Anode Assembly

The above construction recommendations were carried out in December, 1945. All renewal structure consisted of second hand steel rail of varying weight and assemblies, depending on the iron tonnage need for a specified 10 year life requirement. Steel rail of 60, 80 and 90 lb. was used for this project.

Anode assemblies for cathodic stations H and I were fabricated on the solid unit basis. Later this practice was altered to consist of 33-ft. units with 5 ft. to 7 ft. of anode parallel cable, the slack existing between units to facilitate lowering the individual units to their trench position.

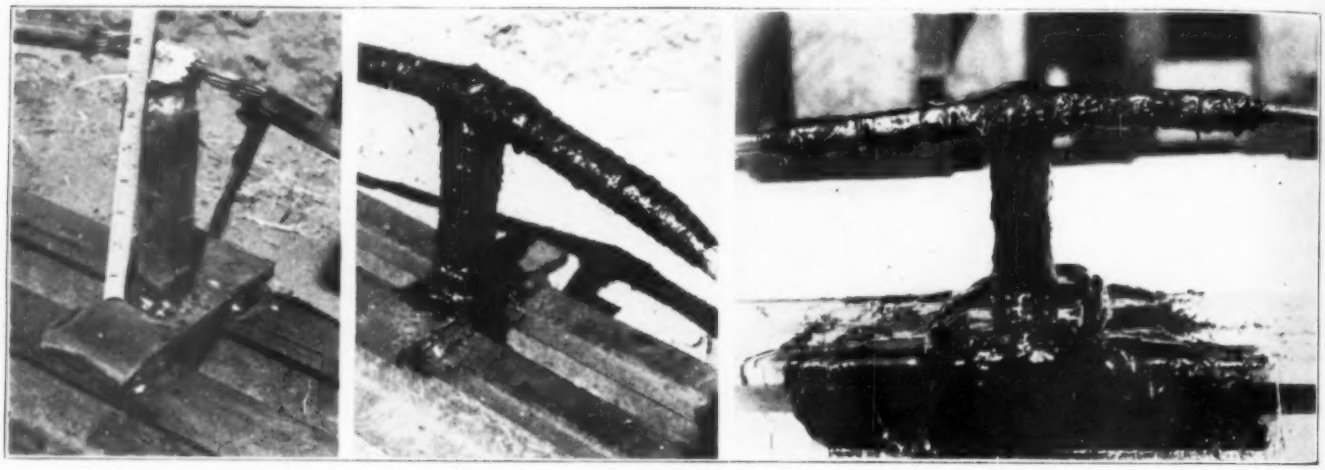
Anode Fabrication Detail

Where a parallel rail installation was established, a ½-in. steel plate was welded to the parallel rails at top surfaces and at 15-foot intervals, but 1.5 feet from either end of the 33-foot steel rail lengths. Care was exercised to provide deep low resistant welds. A 1x7-in. iron rod stud was placed on the top center of this steel plate.

To facilitate anode gradient testing, a ½-in. iron test rod was welded as an extension to the 1x7-in. steel rods on each end of the anode and at the main anode cable junction.

Parallel Anode Cable Design

Rubber insulation of 6-in. length sections was removed from the parallel 4/0 copper anode cable to correspond to the 1x7-in. iron stud locations. These exposed copper sections were then brazed to the iron stud ends. All copper-to-iron connections were provided with right angle junctions. A right angle junction is important because it provides a better job of insulation. Slack was established in the anode cable for all rigid structures to eliminate any danger of cable stress when the anode was to be lowered into its trench position. The exposed copper and iron surfaces were first painted with a P & B in-



Three Successive Stages in the Insulation of Anode Parallel Cable Junction Location

sulating paint and further insulated with eight thicknesses of carefully stretched rubber tape. This operation was followed by an application of two thicknesses of P & B tape and a final coating of asphalt and asphalt saturated muslin. All steel areas at these 15-foot junctions were provided with an asphalt application of no less than ½ inch.

On the parallel steel rail structure designs, earth coffer-dams were installed on each side of the ½-in. steel plate rail tie to provide a basin for hot asphalt. Care was exercised to acquire an asphalt seal under the steel plate junction.

The 1x7-in. iron stud parallel anode cable junction fixture provides an electrical continuity safety factor. Some operators have reported interrupted cathodic protection service due to failure springing from severed parallel anode cables of various junction insulation practices.

This type of anode junction insulation practice has been observed with a life of more than 10 years, with no report of dielectric breakdown.

Where it was feasible, the existing anode was exposed at 50-foot intervals and 1-inch reinforcement steel was welded between the old and the new structures to utilize the remaining old iron value. Heavy applications of asphalt were made to this building steel at its point of contact with the old and new anode systems.

Bulldozers were used to provide smooth right-of-way surfaces for the machine ditcher operations. They also proved to be efficient for earth backfilling work.

One-half Inch Iron Rod Anode Voltage Gradient Test Facility

Earth Moving Equipment

In spite of some rather difficult terrain conditions on anode right-of-way locations, all trenching was accomplished by machine. Power cranes were used to lower the various anode lengths into their trench positions.

Present Operation

Although these anode renewals returned drainage values to normal, it soon followed that anodes for cathodic stations D and J experienced varying degrees of failure.

Four temporary repairs on cathodic station D anode and one for corrosion eliminator station J anode returned forced drainage values to normal or near normal values.

AWWA's Stand on Pollution Legislation at the Federal Level

The following is a statement of policy developed by a special committee of AWWA and unanimously endorsed by its Board of Directors meeting in Chicago on January 14, 1947.

1—The American Water Works Association has a continuing and vital interest in the reduction of pollution of surface waters in the United States.

2—The Association holds that the primary responsibility for control of stream pollution rests with the states, their political subdivisions and the industries therein located.

3—Recognizing that rivers do not respect state lines, the Association agrees that coordination and promotion of stream pollution correction can be facilitated by limited legislation at Federal level.

4—The Association favors Federal legislation in the field of stream pollution control which:

a—Will use to the greatest possible extent existing authorities and facilities for the control of stream pollution.

b—Designates the U. S. Public Health Service as the Federal administrative agency.

c—Provides, in the classification of waters, for the cooperation of the U. S. Public Health Service and the State Pollution Control Authority.

d—Where no such state agency exists, grants to the Surgeon General, U. S. Public Health Service, the authority to integrate the stream classification of such state with the classification of the streams in adjoining or affected states where state authority exists, subject to ratification by such state authority when created; and

e—Provides for an advisory board with adequate representation of state water pollution control authorities.

5—The Association does not favor the use of grants-in-aid in the stream pollution abatement program. If and when the use of grants may be adopted as a national policy for a general construction program, obviously plants for pollution abatement should be included in that program.

6—The Association opposes the entrance of the Federal Government into the regulatory field through court action. The states should continue their jurisdiction unhampered in this field.

Wrought Iron Rungs Give Half Century of Service

Wrought iron rungs set in masonry in the 85-ft. Main Avenue water tunnel shaft in Cleveland are to be replaced with wrought iron ladders after having served 50 to 55 years, according to Cleveland officials. The old rungs in the Main Avenue shaft are to be burned off when the new ladders are ready for installation. These will be 68 ft. long, with 2½ in. x ½ in. material for the sides and ⅞ in. round rungs, 15½ in. long and spaced 12 in. apart.

HYDRAULICS FOR THE PRACTICAL WATER WORKS MAN

The Sixth of a Series of Articles

Discharge Through Long Lines of Pipes of Different Sizes.

By ROBERT W. ANGUS, M.E.*
Consulting Engineer
TORONTO, ONT.
Honorary Member A.W.W.A.

IN the previous article of this series (*W. & S. W.*, Dec., 1946) flow through parallel pipes was considered and the method of finding out the improvement resulting from laying a pipe parallel to a part of a main, to which it was connected at both ends, was explained. In water works distribution systems there are, of course, many such parallel pipes and the mains are so tied together that there are generally a number of paths by which water may travel from one point to another. Ordinarily the system is made up of a complicated network, with many cross connections, and the determination of the conditions of flow in such a network is a very difficult and tedious problem, much beyond the scope of this series of articles. It is, in fact, a problem with which the skilled technical engineer has much difficulty.

*Professor Emeritus of Mech. Engineering, University of Toronto.

The Author

One useful problem which does belong to the field being covered but which has not yet been dealt with in this series is that of finding the discharge through a line of pipe made up of several lengths of different sizes of pipe attached end to end. To illustrate this let us suppose that an old 12 in. pipe 2000 ft. long has been extended by adding 800 ft. of new 10 in. pipe, and that this line goes from a pumping station, near which the pressure on the 12 in. pipe is 80 lbs. per sq. in., to a point at elevation 45 ft. above the pumping station, at which point the pressure must not fall below 50 lbs. per sq. in. How much water will the main deliver? This line is shown on Fig. 22, and in calculating the flow it will be assumed that there are no elbows or other sources of loss beyond those due to the straight pipe. The pipes are assumed connected by a tapering reducer in which the loss is comparatively negligible.

In the first article (*W. & S. W.*, July, 1946) it was stated that each pound per square inch corresponded to that of a column of water 2.31 ft. high, so that the pressures on the line are $80 \times 2.31 = 185$ ft. and $50 \times 2.31 = 115.5$ ft. at the pumping station and discharge ends, respectively. The statement in the third article (*W. & S. W.*, Sept., 1946) that the sum of the elevation head, the pressure head, and the velocity head

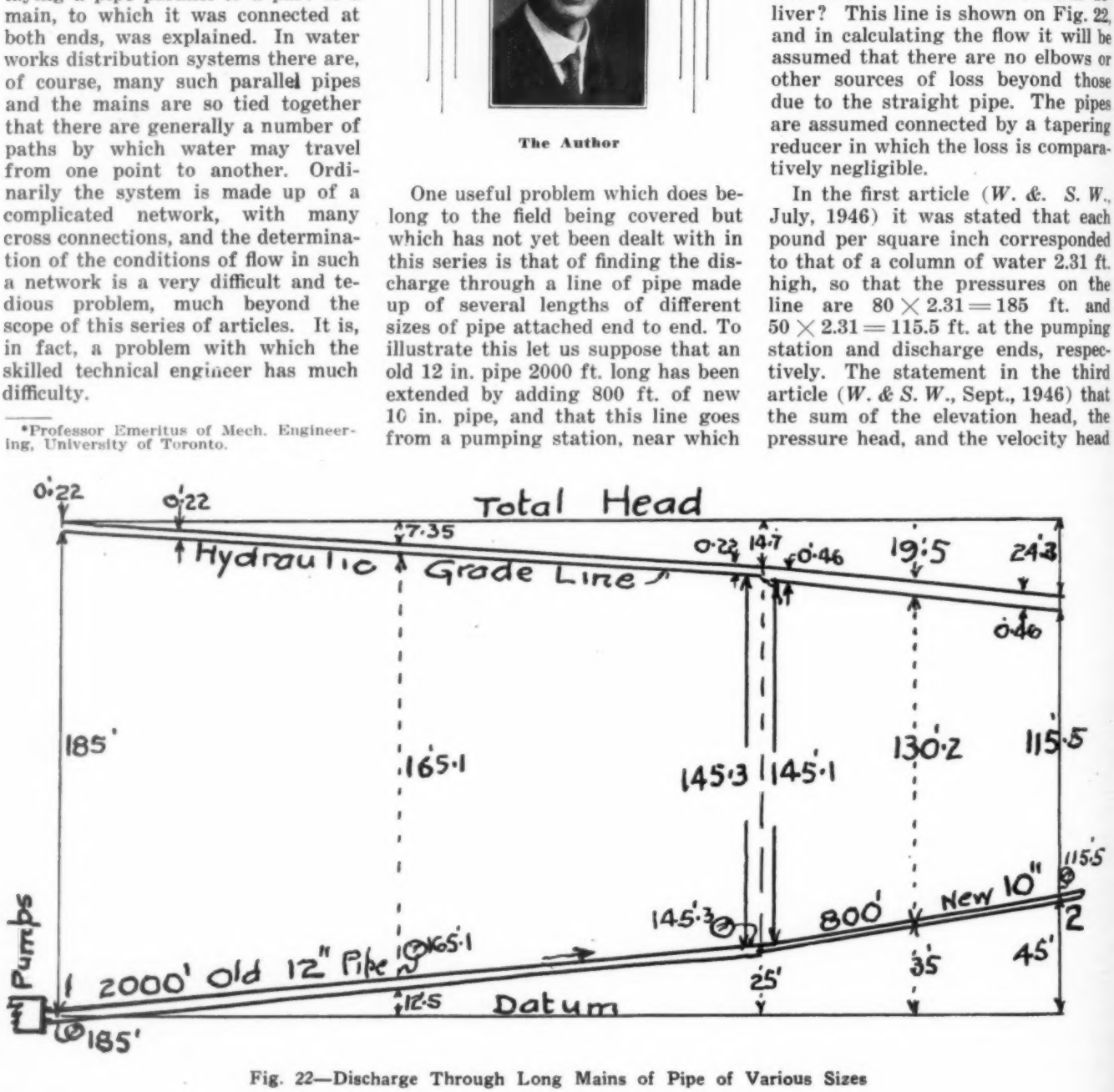


Fig. 22—Discharge Through Long Mains of Pipe of Various Sizes

TABLE I
Velocities in Pipes

Pipe size (in.)	Actual diam. (in.)	Area (sq. ft.)	Velocity ft. per sec. for 100 U. S. gal. per min.	Pipe size (in.)	Area (sq. ft.)	Velocity ft. per sec. for 1,000 U. S. gal. per min.
1	1.049	.00600	37.1	4	.0873	25.50
1¼	1.25	.00852	26.2	6	.1963	11.33
1½	1.50	.01227	18.2	8	.349	6.37
2	2.067	.0233	9.6	10	.545	4.07
3	3.068	.0513	4.3	12	.785	2.83

1,000 U. S. gallons per minute = 1.44 million gallons per 24 hours. One cubic foot per second (1 cfs.) = 450 U. S. gallons per minute (450 gpm.)

at the first or upstream gage point must equal the sum of the same three heads added to the friction loss between the points, at the downstream gage point will now be applied here, and the datum will be chosen through the gage point near the pumping station. Then $0 \div 185 + v_1^2/64.3 = 45 + 115.5 + v_2^2/64.3 + F$ and we shall first proceed to find the loss F in feet between the gage points. It is given by

$$F = f_1 \times \frac{2000}{12/12} \times \frac{V^2_1}{64.3} + f_2 \times \frac{800}{10/12} \times \frac{V^2_2}{64.3}$$

and in this type of problem it is best to find the relations between the two velocities at once, so that one of them may be written in terms of the other. This is easily done, since for the 12 in. pipe the area of it multiplied by v_1 must equal the area of the 10 in. pipe multiplied by v_2 and, referring to Table I, this means that $0.785\ v_1 = 0.545\ v_2$. Therefore, $v_2 = 1.44\ v_1$ and we may also write $v_2^2 = (1.44)^2\ v_1^2 = 2.074\ v_1^2$.

Looking at Table II of friction factors and taking those corresponding to reasonable velocities, it will be seen that the value of f_1 for new 12 in. pipe is given in the table as 0.022. But as we are dealing with old pipe it will be assumed that the friction has increased 50 per cent above the values given, although the amount of this increase must be estimated by inspection of the pipe or by measurement of the friction in the old pipe. The value 0.033 will be used for f_1 and the table gives a fair average value of 0.022 for f_2, which will be adopted for the new 10 in. piece; closer values for f are not necessary in the first calculation as we do not yet know the velocities. Using these values of the friction factors in the formula already set down above gives the relation $F = .033 \times 2000 \times v_1^2/64.3 + .022 \times 960 \times 2.074\ v_1^2/64.3$, and when this is worked out it gives $F = 1.71\ v_1^2$. Putting this value in the first equation above gives $185 + v_1^2/64.3 = 160.5 + 2.074\ v_1^2/64.3 + 1.71\ v_1^2$ from which v_1 is easily found to be 3.78 ft. per sec. and the corresponding value of v_2 is $1.44\ v_1$ or 5.44 ft. per sec.

This result must now be checked because the values of f had to be taken from the table without a knowledge of the pipe velocities, but it is evident that the chosen values of f happened to correspond with the velocities actually existing. Had they not done so, it would have been necessary to recalculate the pipe with the more correct values of f. For example, suppose we had started with values of 0.03 for f_1 and 0.02 for f_2, then the calculated values would have been 3.95 ft. per sec. in the 12 in. pipe and 5.69 ft. per sec. in the 10 in. pipe and, on referring to Table II for friction factors, we would have found that the value of f for new pipe, corresponding with these values, would have been 0.022 in both cases, and we would have had to repeat the calculation with the revised values of f and would have obtained the same final answer as we got in the first instance. There is usually no way of avoiding the double calculation if accuracy is desired, but experience is helpful in shortening the work in most cases, although even with it the work has often to be done twice over. Some persons may prefer using Fig. 18 (*W. & S. W.*, Nov., 1946) for solving this problem, although the writer likes the method given here and often only an approximate result is required.

To get the discharge all that is necessary is to multiply the velocity in the 12 in. pipe by its area, which gives $3.78 \times .785$ or 2.96 cu. ft. per sec., and on referring to Table I this corresponds to $2.96 \times 450 = 1330$ gal. per min. The loss of head in friction in the line is $F = 1.71 \times 3.78^2$ or 24.3 ft., and it is easy to show that 14.7 ft. of this is lost in the 12 in. pipe and the remaining 9.6 ft. in the 10 in. pipe. All the hydraulic lines for this case have been drawn on Fig. 22 and some of the pressures are indicated.

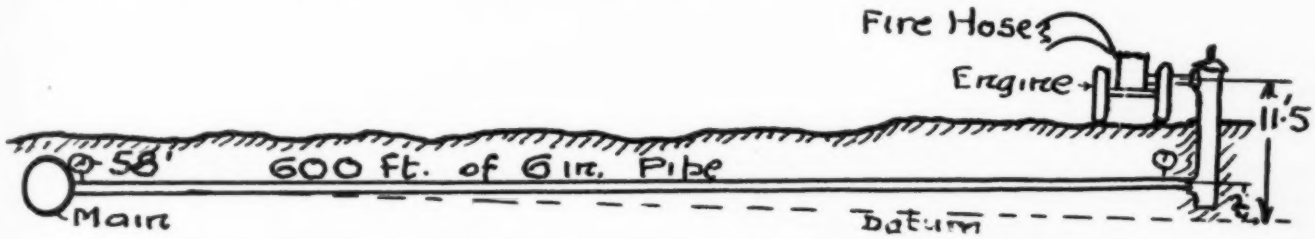


Fig. 23—Example of a Fire Pumper Attempting to Take a Full Supply from a 6 in. Line

Fire Engine Supply Mains

Another application of these principles will be made to a problem which has caused some distress to water works men at times. The difficulty arises during a fire, when a fire engine is drawing water from the distribution system so as to increase the nozzle pressure. Unfortunately, there is most need of the engine if the fire is located in a part of the town where the pressure is low in the main, and this further augments the trouble now being discussed.

The sizes of fire engines vary, but let us suppose that this town has one of the larger pumpers having a capacity of 1000 U. S. gallons per

TABLE II
Friction Factors for Smooth, Clean, Coated Cast Iron Pipes
(Add 5% for riveted steel and at least 50% for old rusted pipes. Copper and brass and lead pipes have lower values.)

Pipe Diameter in.	Velocity in Pipe, Ft. per. Sec.					
	1.0	2.0	3.0	4.0	5.0	10.0
1	.035	.032	.030	.029	.027	.024
2	.033	.030	.028	.027	.026	.024
4	.031	.028	.026	.025	.025	.023
6	.029	.026	.025	.024	.024	.022
12	.025	.023	.022	.022	.021	.020
16	.023	.022	.021	.021	.020	.019

minute, and that in dealing with a fire it is attached to a hydrant on a 6 in. water line which is fed from a larger main 600 ft. away. The velocity in the 6 in. pipe necessary to satisfy the full demand of the engine would be 11.33 ft. per sec. (Table I) and this is very high, but we shall examine the case in detail. If the pipe is new, the friction factor f is 0.022 (Table II) and the velocity head is 2.0 ft. from Fig. 12 (*W. & S. W.*, Aug., 1946), so that the loss of head in friction in the 600 ft. of pipe will be $F = .022 \times \frac{600}{6/12} \times 2 =$ 52.8 ft., or practically 23 lbs. per sq. in.

In addition to the loss in the 6 in. pipe there will be a further loss in the hydrant and still more in the connection between the hydrant and the 6 in. pipe. Since hydrants vary a good deal in construction, it is impossible to state the friction losses in them without full knowledge of their characteristics, but with a well made hydrant, through which 1000 gal. per min. is flowing, the friction loss from the 6 in. cast iron pipe to the suction inlet on the engine could hardly be less than 7 ft., and this number will be used here. The total friction loss between the point where the 6 in. pipe leaves the large main and the suction branch of the engine (taken as 6 in. bore) will then be $52.8 + 7.0 = 59.8$ ft.

Now let us suppose the pressure on the 6 in. pipe close to the large main can be maintained at 25 lbs. per sq. in., or 58 ft. of water, with this draft and that the 6 in. pipe slopes upward 2 ft. in its length (Fig. 23) entering the hydrant at a level 9.5 ft. below the suction branch of the engine. The latter is, therefore, 11.5 ft. above the large main. Taking the datum through the beginning of the 6 in. line, we would find the suction pressure p in ft. at the engine from the equation, $0 + 58 + 2 = 11.5 + p + 2 + 59.8$, from which p is found to have a negative value of 13.3 ft., in other words, there is a vacuum of 13.3 ft. at the engine inlet. Obviously the engine must be connected to the hydrant by suction hose that cannot collapse and thus a special suction hose would be necessary.

So far we have proceeded on the assumption that the 6 in. pipe was new, but if it happened to be old and in such internal condition that the friction had an increase of 25 per cent, for instance, above that corresponding to the friction factors in Table II, then, instead of a friction loss of 52.8 ft. in the 6 in. pipe, this will be increased to 66.0 ft. and the vacuum at the engine would be increased by 13.2 ft., bringing it up to 26.5 ft., which is so high that no portable engine would work satisfactorily, even if the suction hose did not collapse. Clearly, under these conditions the 6 in. pipe is too small to supply the 1000 gallon engine and the engine could not work up to capacity unless the pressure in the distribution system could be raised.

We might now see what advantage there would be in using an 8 in. pipe instead of the 6 in. For an 8 in. pipe the velocity necessary to deliver 1000 gal. per min. would be 6.37 ft. per sec. (Table I), which is still high,

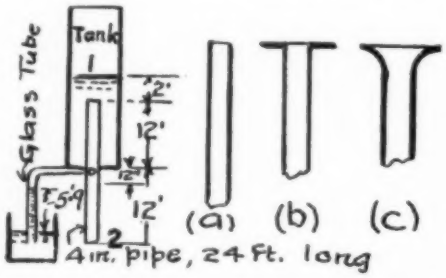


Fig. 24—Discharge Capacities of Tank Overflow Pipes of Various Inlet Designs

but the resulting friction loss in the pipe would only be 13.0 ft. (Table II) if the pipe was new, instead of the 52.8 ft. loss in the smaller pipe. With the larger pipe, even when it is old enough to show an increase in friction of 25 per cent above that for new pipe, there will be a suction *pressure* of 21.5 ft. at the engine, which is more than required. This problem illustrates the decided advantage of the larger line. As a matter of fact, a 6 in. line is too small to supply fire hydrants in most places.

Overflow Pipe in a Tank

We shall next turn attention to the tank with overflow pipe as shown in Fig. 24, the dimensions being indicated there, and we shall assume the pipe to be new and 4 in. inside diameter, although if steel pipe is used it will be slightly larger. The discharge is freely into the atmosphere and we wish to find how much water this overflow can carry away if the water in the tank is not to rise over 2 ft. above the top of the pipe. There are three ways in common use of shaping the inlet end of the pipe and these are shown at (a), (b) and (c) on Fig. 24. For the case (a) no special device has been used at the pipe end except to cut it off square at the end and remove any burrs, but the edges have not been rounded in any way. For the case (b) a flat plate about 15 in. diameter has been fitted to the pipe so that the top of the plate is just flush with the top of the pipe, an arrangement sometimes referred to as the "standard end." In the case (c) a bell mouth has been attached to the top of the pipe, which, of course, involves some expense.

We shall now see what effect these ends have on the discharge, and since the resistance at entrance is not small compared with the other losses, we shall approach the matter in a somewhat different way to that of using the entrance losses as given in Table III (*W. & S. W.*, Nov., 1946), although that method may be used if desired and will give substantially the same results as the one now to be used. Substituting an equivalent length of straight pipe for an entrance loss is a little more accurate where the pipes are long than where they are short. Many experiments have shown that the entrance loss in case (a) is 80 per cent of the velocity head in the pipe, for case (b) it is only 50 per cent of the velocity head, while for case (c) it falls to only 10 to 20 per cent, depending on the shape and finish of the bell, and we shall use 15 per cent in this example.

Following the method already laid down, of adding the elevation, pressure and velocity heads at the first section and equating this sum to the sum of the same three heads at the second section plus the friction head lost between the sections, we shall choose the first section at the surface of the water in the tank and the second section at the discharge end of the pipe, and the datum will be chosen through the second section. For the first section we have only the elevation head of 26 ft., since the pressure and velocity at that point are each zero, so that $26 = 0 + 0 + v_2^2/64.3 + F$, since both the pressure head and the elevation heads at section 2 are zero.

The friction head F is the sum of the loss at entry and that in the straight part of the pipe and for the entrance (a) this becomes $(0.8 + f\ l/d)v_2^2/64.3$. The value of f is taken from Table II for a high velocity since the velocity in the pipe is likely to be large. A suitable value is probably 0.022. Further, l is 24 ft. and d is 4/12 ft., and from these the value of f l/d is 1.58. Putting this value in the last equation in the paragraph above gives $26 = (0.8 + 2.58)v_2^2/64.3$ for the case with the entry end (a), from which the pipe velocity is easily found to be 22.2 ft. per sec. which corresponds to a discharge of 870 gal. per min. as found from Table I. Putting in the entry

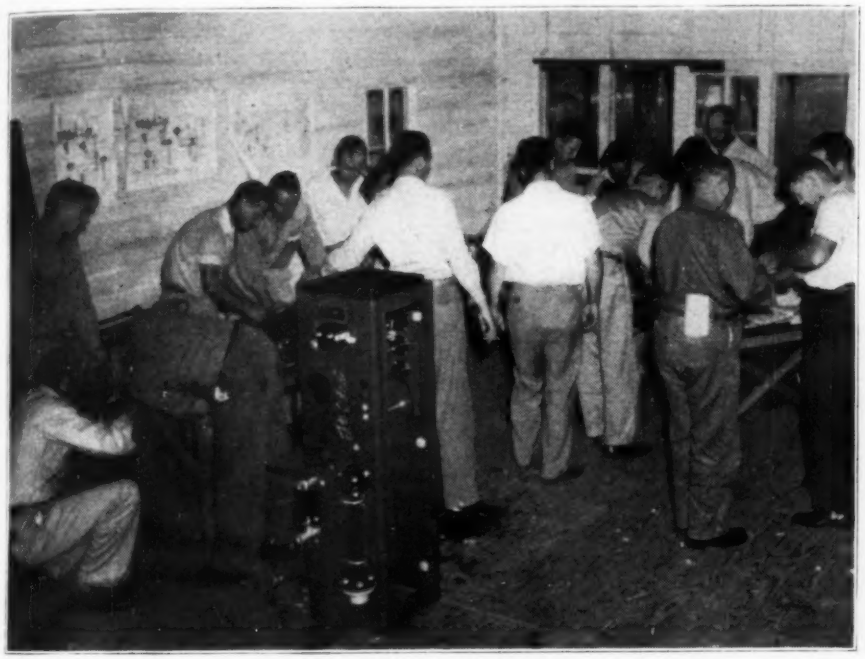
values 0.5 and 0.15 (50 per cent and 15 per cent) for entrances (b) and (c), respectively, results in a calculated discharge of 913 gal. per min. (velocity 23.3 ft. per sec.) for entrance (b) and 957 gal. per min. for the bell mouth entrance, this corresponding to a velocity of 24.4 ft. per sec.

It is easy to show that a gage attached to the pipe at the base of the tank will show a vacuum of 5.9 ft. so that if the lower end of the pipe is cut off, the discharge will decrease. To put this into definite figures let us suppose that the pipe is cut off one foot below the bottom of the tank, reducing its length to 13 ft. and bringing the original head of 26 ft. down to 15 ft., then it will be found that the discharges are reduced to 747 gal. per min. for the end (a), 792 gal. per min. for the end (b), and to 860 gal. per min. for the bell mouth end, reductions which are considerable. The end condition evidently has a marked effect on the discharge and the expense involved in improving this condition is often not serious. There may be a slight error in the friction factor as the table does not go up to these high velocities, but the results are close to the correct ones.

(Additional installments of this series will follow.)

TEXAS HOLDS FIRST CHLORINATOR REPAIR AND MAINTENANCE SCHOOL

Patterned After Successful Meter Repair Schools of Texas



First Texas Chlorinator Maintenance and Repair School
(Learning what makes and what keeps the wheels going in various types of chlorinators.)

On October 8th and 9th what is believed to have been the first Chlorinator Repair and Maintenance School for plant operators and engineers was held at Port Neches, Texas, with Dave H. Smallhorst in charge. Sponsor of the two-day school, the Texas Water and Sanitation Research Foundation was gratified at the interest shown in this school.

Each man attending had to tear down and assemble a chlorinator. Wallace & Tiernan Co., Inc., had several men assisting in the school. The controls would be purposely thrown out of kilter and the student would have to reset the controls correctly. "Learning by doing" was the theme of this repair and maintenance school and those in attendance were high in their praise of the valuable experience received in the two-day intensive training.

It is the present plan to hold a two-day school in each of the 22 Texas Water Works Association district areas where there is enough interest demonstrated to undertake the work. Texas is unique in having district associations over the State holding monthly meetings. In addition, there is the time honored Texas Water Works Short School, which is held annually at Texas A. & M. College.

The Texas Water & Sanitation Research Foundation sponsored Water Meter Repair Schools have come to a close. W. A. Bandy, who had charge of these meter repair schools, has indicated that the six which were held will be all that will be held for the time being.

The Chlorinator Repair and Maintenance Schools already held, and those scheduled are as follows: Calallen, Texas, November 12-13 (Coastal Bend District Water Works Association area); Harlingen, Texas, December 9-10 (Lower Rio Grande Valley District Water Works Association area); San Antonio, Texas, January 14-15 (Mission District Water Works Association area); Eagle Pass, Texas, February (Wintergarden District Water Works Association area); Austin, Texas, March 11-12 (Capitol District Water Works Association area); Temple, Texas, April 8-9 (Central Texas District Water Works Association area); with other schools to be planned later. The Texas State Department of Health is assisting in the work.

T. H. Milford, Chief Engineer, Alabama State Health Dept., Killed in Accident

Arthur N. Beck Promoted to Head Department

Too late for inclusion in our last issue came the tragic news that Thomas H. Milford, Chief Engineer and Director of the Bureau of Sanitation of the Alabama State Health Dept., had been killed in an automobile accident in Montgomery, Ala., in November.

Mr. Milford, a graduate of Texas A. & M. in 1926, had been employed by the Alabama State Health Dept. upon graduation. In 1932 he attended Harvard University and received the degree of M.S. in Sanitary Engineering. For a period of two years thereafter Milford was connected with an engineering company in Birmingham, Ala., returning to the Alabama State Health Dept. on August 1, 1942, as Chief Engineer and Director of the Bureau of Sanitation, in which position he served until his death.

To replace Mr. Milford, the Alabama Dept. of Health appointed Arthur N. Beck, formerly Assistant Sanitary Engineer, as Chief Engineer and Director of the Bureau.

DIESEL ENGINES IN MUNICIPAL USAGE*

By R. H. MORSE, JR.
Vice President and General Sales Manager
FAIRBANKS, MORSE & CO.
CHICAGO

THE reliability, dependability, splendid fuel economy and long life of the modern stationary Diesel engine are too well recognized to merit comment here. Not so often emphasized but equally worthy of mention are two other features of the Diesel that are especially advantageous in stationary applications. *The first* is that a Diesel unit will go into operation, carrying its full load, in a very short time. *The second* is that the high standard of Diesel economy is attained regardless of the size of the unit.

It is estimated that there are today between five and six million horsepower of stationary Diesel engines in use in the United States, and this figure does not include the engines which were supplied to meet the requirements of our armed forces. Seventy-two per cent of this five or six million horsepower total is distributed as follows: It may be surprising to know that municipal power plants are using 27 per cent, and private utilities and R. E. A. cooperatives take 14 per cent. Twelve per cent are on the oil pipe lines and otherwise working for the oil industry; cotton gins and oil mills account for eight per cent; the grain industry is using six per cent; the remaining five per cent of the accountable 72 per cent are at work making ice and providing other refrigeration. The miscellaneous unclassified 28 per cent is scattered through industries such as mining, rock and clay products, textile mills, lumber and woodworking, irrigation, metal working, and in water pumping.

Diesel Design Improvements

With the vast improvement which has been made in the design and construction of today's Diesel engines, we believe that one can look forward to a continually increasing use of this source of power. Modern trends in design are producing engines which are suited to jobs where the older and more cumbersome engines of earlier design could not compete

The Author

economically with other sources of power supply.

Present day Diesels lend themselves more readily than their forebears to satisfactory installation in city buildings. The higher rotative speed now offered in Diesel design results not only in a reduction of the space required for proper installation of the unit, but this greater speed also simplifies the problem of vibration isolation—always a real factor in engineering and planning municipal installations.

By-product Heat Utilization

More attention should be devoted to efficient utilization of that useful and valuable by-product of Diesel power—HEAT. The possibilities for waste heat recovery and utilization are just beginning to be appreciated, and for all of our smug boasts of the efficiency of Diesel engines, we should not forget that in most installations better than sixty Btu. of energy are thrown away in the form of heat for every forty that we convert from fuel oil into motive power. Better engineering and more research should expand the applications of heat recovery and thereby widen the Diesel's field of profitable application.

Especially Advantageous in Water Pumping

While municipal electric light plants have been absorbing a large percentage of Diesel engine production, only sparse attention has as yet been directed toward expanding the practice of water and sewage pumping with this economical and *always dependable* kind of power. The Diesel is ideally suited to this service and there is no stationary application where the Diesel can show to better advantage than in pumping a community or industrial water supply.

An outstanding example of Diesel pumping is to be found at Burlington, Vermont. Here the city operates a municipal electric light plant on cheap and abundant hydro power. Burlington's power cost is less than a cent per kilowatt hour, but the economy of a Diesel, operating under the nearly constant load which prevails in a water works pumping station, is so great that the City of Burlington finds it more economical to pump its water with a Diesel engine.

The Dual Fuel Engine in Sewage Works Power Production

We are entering an era that will witness sweeping changes in the sanitary facilities of our municipalities throughout the country. Thousands of new municipal sewage treatment and industrial waste treatment plants are on the drawing boards. Many sewage treatment plants that are already in existence are due for needed enlargement and modernization. Here Diesel engine producers look forward to an expanding market for its newly developed and increasingly popular dual fuel engines. These engines utilize the by-product methane gas generated in the treatment plants to produce most if not all of the power required for their operation. At times when the by-product gas is not sufficient for all power production auxiliary fuel oil to the required extent to meet the deficiency is fed to the engine along with the gas. In consequence of this development, engineers can now plan the installation of by-product gas utilizing engines without fears that the installation might prove uneconomical due to periods of deficient gas production and consequent intermittent operation of the engines, which has precluded dependence on this natural source of power in many instances, notably in the smaller sewage treatment plants.

*Excerpts from a paper read by the author before the A.S.M.E. in Milwaukee, Wis.

WISCONSIN SECTION HAS SILVER ANNIVERSARY

Holds Meeting in Historic Old Green Bay

MEETING on Nov. 15, 16, 17, in Green Bay, Wis., the oldest city in the Northwest, the Wisconsin Section of A. W. W. A.,

Chairmen

Incoming	Outgoing
J. J. McCarthy	*Harold L. Londo*
Chemist	*Superintendent*
Racine	*Green Bay*

founded some 300 years ago, held its quarter century anniversary. This was the second time the section had met in that city. According to Leon Smith, Secretary, the section had met twice in several other cities also and only Milwaukee had served as a meeting place as many as five times.

This particular meeting was unique in that it is probably the first time any section has ever held a meeting beginning on Friday and ending on Sunday noon. This unusual schedule was brought about by necessity for available hotel accommodations, and despite this somewhat different scheduling, attendance at the last session was gratifyingly large.

Another unique feature of this meeting was a fish fry, held at the local American Legion Post and attended by every person who had registered up to that time. Fish fry—that's a table piled with perch, shrimp, and French Fries and surrounded by hungry water works men demonstrating again that fingers came before forks.

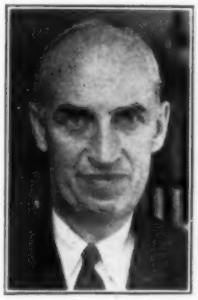
As was hoped for this gala anniversary, the attendance record was broken. A previous high had been 254, but this meeting topped that figure by at least a dozen. Much credit for the splendid showing is due to the secretary, the program committee, and the committee on local arrangements. Unfortunately for this reporter, this session lacked the community singing which he had been told was a treat to hear.

Another unique feature of this meeting was the use of motion pictures to begin each session. Pictures of the Green Bay Packers professional football team, pictures of floods, of deep sea fishing, and so forth, were used. Strange to say, while it was expected to use these pictures only as a device to get the crowd in before the first speaker went on and thereby prevent confusion during the first paper, these motion pictures actually drew the crowd in when they started. Apparently conventioneers like to see movies before they hear technical papers. This reporter can highly recommend the use of this idea in technical programs.

Business Meeting

Officers elected for the ensuing year were as follows:

Chairman
J. J. McCarthy, Chemist
Water Department, Racine



Officers

Secy.-Treas.	A.W.W.A. Director
L. A. Smith	*Jos. P. Schwada*
Superintendent	*City Engineer*
Madison	*Milwaukee*

Vice Chairman
Verne Somers, Superintendent
Water Department, Stevens Pt.

Director
James A. Snow, Superintendent
Water Department, Ashland

Secretary-Treasurer
L. A. Smith, Superintendent
Water Department, Madison

A. W. W. A. Director
Joseph P. Schwada
City Engineer, Milwaukee

Fuller Award

The Fuller Award for 1946 was voted to **James Myers,** Supt. of Water, Kenosha, Wis., for "his success in reducing the losses in his Distribution System, and his interest in the A. W. W. A. and the Wisconsin Section."

Water Supply and Industry

Vice President of A. W. W. A. **N. T. Veatch,** Cons. Engr. of Kansas City, Mo., spoke on the subject of "Water Supply and Industry" and told his audience not only of the value of the water works industry to industry as a whole, but of the value of the water works industry to the citizens of a community. When a product as important to the life of the individual as well as to the life of the community sells for the extremely low price of approximately 4 cents a ton, it is apt to be ignored in the economy of the community. It cannot be ignored, however, for without it there would be no industry, no commercial enterprise; in fact, no community.

Mr. Veatch pointed out that one of the weaknesses of the water works industry is the lack of uniform accounting practice, and he asked that the profession as a whole strive to remedy that defect. Mr. Veatch also complimented Wisconsin on its Public Utility Commission which, while successfully keeping politics out of its operations, has done a wonderful job in controlling both public and private water utilities in Wisconsin with, as one means, a uniform accounting system.

In off the floor comments, **A. P. Kuranz** of Waukesha said that of 58 public water supplies, 39 have a commission form of management. In these 39, the average service of the superintendent is 15 years and would be greater except that death

Vice-Chairmen Fuller Award

Verne Somers	*Jas. Myers, Jr.*
Superintendent	*Superintendent*
Stevens Point	*Kenosha*

had removed a couple of old-timers within the past year or two.

Association Activities

Speaking on the activities of the A. W. W. A., **Harry E. Jordan,** Exec. Secy., emphasized the need of the water works utilities for materials, not only for new extensions, but for long delayed maintenance as well.

It is an anomalous situation that now with the war over and restrictions not only eased but discontinued, there is less material for water works than when W. P. B. restrictions were in effect. Thus it appears that as much as we decry restrictions and governmental regulations, the only way we can hope to have sufficient materials in this field of endeavor is to have regulation. Particularly is this true if the housing program should go forward, for water works utilities will need three times the normal demand for pipe, fittings, and other materials.

Mr. Jordan cited the situation in Los Angeles, where it was discovered that commitments for new services had been made to the extent that four times the normal cast iron pipe consumption was needed.

Unfortunately, Mr. Jordan was not able to give any date at the time for the appearance of the first brochure on Public Relations because strikes of one kind or another had thrown off the whole production schedule.

Mr. Jordan closed his talk with congratulations to the Wisconsin Section for winning the Henshaw Cup for attendance for 1945. This general session had been presided over by Chairman **Harold Londo,** Supt., Green Bay.

MANAGEMENT SESSION

The afternoon session on management problems was presided over by **Arthur P. Kuranz,** Manager, Waukesha Water Dept.

Public Relations

(Assoc. Ed. Note: It is difficult for this reporter, when reporting his own part in any program, to decide whether to report it straight or whether to give it the treatment it would receive if it were written for his column, "Here and There," in the back of the magazine. Perhaps somewhere between would be about right. At any rate, here it is.)

Choosing again the somewhat facetious title, "How Are Your Relations—Public, That Is?" **George E. (Doc) Symons,** Assoc. Ed., *Water & Sewage Works,* New York City, talked about Public Relations in Water Works. By using stories of actual happenings to illustrate the several points, the attempt was made to point out the importance of public relations to the worker, the owner, the customer, and the "peddler."

As a definition of public relations, the following was offered: The practical and continuous cooperation between owner, management, and labor on one hand and the consumer on the other to the extent that the service rendered shall be satisfactory to all concerned.

One of the most vital factors in this cooperation is the truthful dissemination of information to all parties concerned. If water works management is to have favorable public reaction, it must be resourceful in telling its story, and it must tell and retell that story to obtain acceptance and appreciation.

There was more preaching about there being no substitute for truth, imagination, resourcefulness, cooperation, and just plain work, and this preaching was sprinkled with anecdotes—some of which amused the audience.

Employees' Retirement Plan

In Wisconsin, legal facilities are available for the establishment of employees' retirement plans in any municipality. This is known as the Wisconsin State Plan and was discussed by **Tom M. McGuire,** Mgr. of the Plymouth Utilities, Plymouth.

Mr. McGuire is heartily in favor of the Wisconsin Plan and urged that all municipalities adopt it Only thing necessary to put it in operation is for the workers to present a petition for the plan to the governing body.

The case for the Private Insurance Company Plan was presented by **F. G. McNamara,** Old Line Life Insurance Co. of America. According to Mr. McNamara, pensions are good business for employees on a dollar and cents basis. In order to produce the best retirement plan, McNamara suggests that the plan must be:

Simple, practical, and workable; flexible; attractive to the employee; and actuarily sound.

On the matter of the actuarial soundness of the plan, Mr. McNamara said this was the point of difference between the state plan and the private insurance company plan. Whereas the state plan gives four per cent interest, insurance companies are only giving 2½ or 2¼ per cent. If insurance companies cannot invest monies to give higher per cent interest, how can the state unless it depends on taxes? Furthermore, more persons reach the retirement age than expected in the case of small numbers in a non-hazardous profession. The state figures used are O.K. for large numbers but do not apply to small groups. Thus the state is finding another reason why funds will not be sufficient without resorting to taxes. The main point of Mr. McNamara's arguments was that private plans gave better assurance of future performance because they were based on better foundations.

Water Supply
T. N. Veatch
Cons. Engr.
Kansas City, Mo.
(V.-Pres., AWWA)

A.W.W.A.
Harry Jordan
Exec. Secy.
AWWA
New York

Pub. Relations
Geo. E. Symons
Assoc. Editor
Water & Sewage
Works, N. Y. C.

Salaries
A. P. Kuranz
Manager
Water Utilities
Waukesha

Among The Programmed Speakers

Pensions
T. M. McGuire
Manager
Utilities
Plymouth

Softening
W. U. Gallaher
Superintendent
Appleton

Salaries and Wages

Under the round-table leadership of **A. P. Kuranz,** Manager of the Waukesha Water Utility, the subject of "Salaries and Wages of Water Works Managers, Superintendents, and Employees" was given a thorough discussion.

Mr. Kuranz quoted the results of a questionnaire answered by 58 of 59 superintendents or managers. Of these, 40 utilities are operated under commissions and 39 of these commissions establish wages and salaries. In 25 of these utilities the managers have some word in developing salary schedules and 21 managers make recommendations on salary and wage schedules.

Questioned about tenure of position, the managers answered as follows:

More Programmers

H. A. Faber
Res. Chem.
Chlorine Institute
New York

K. V. Hill
Greeley & Hansen
Chicago, Ill.

1- 4 years	5
5- 9 years	10
10-14 years	17
15-19 years	11
20-24 years	6
25-40 years	9

Thirty-five managers had held other positions in the water works before assuming the top position.

From this brief questionnaire and survey, Mr. Kuranz concluded that "the Wisconsin water works manager has a stable job and most managers have made their jobs a profession as well as vocation." Saying that these managers "belong to a strange element of society which is concerned with service to others even though at times the burden is almost heavier than the men can bear," Mr. Kuranz introduced and opened the discussion on salaries and wages.

From Racine, Walter Pierce said he was having union troubles, mainly over salary increases, while James Snow, of Ashland, asked how many utilities had unions (the answer was eleven) and W. U. Gallaher, Appleton, said that unions had done some good and should not be censured unreservedly.

James Kerslake, Milwaukee, quoted Washington salary classifications for mechanics, and suggested that the simple solution to salary raises is to compare pump operators and filter plant operators to journeyman maintenance mechanics and adjust the pay scale from there. A check of several plants indicated that only five pay equivalent to a mechanic's wage, two pay more, and many pay less.

Horace Frye, Evanston, said his utility didn't compare with other cities because of its location next to Chicago, but he liked Mr. Kerslake's ideas and would like to see published a scale of proper salaries. In Marinette, according to Ernest Bowman, Supt., other city authorities want to know why water works men should get more money. Mr. Bowman would like to have a good answer to give them.

James Myers, Jr., of Kenosha, who remarked about the permanence of water works jobs as one of the features, also liked Kerslake's idea. In his own utility hourly wages have gone up 40 per cent in the last four years but are still low—this increase is partly due to a $30 a month cost of living bonus. With 11,000 accounts for a population of 55,000 and 40 employees, Mr. Myers does not think he is overstaffed; this is one employee to each 1,350 persons. One of the difficulties of keeping employees happy in his water utility is that they compare their income with that of employees of the Nash-Kelvinator company, often to a disadvantage.

LaVerne Trentlage of Elgin, Ill., believes that the "water works utilities will be forced to meet the labor issue because labor is in the driver's seat." In his own utility, he found that putting the meter readers on an incentive pay basis upped the number of meter readings per day.

In response to a question from Mr. Kuranz as to whether or not the A. W. W. A. could do anything to help out the present confused situation, Harry Jordan said that this was the first time he had ever heard such a discussion in a sectional meeting. On the national level, Mr. Jordan believes that the development of a broad public relations program must come first, to be followed by a sane approach to the problem of salaries and wages.

SURFACE WATER SUPPLIES

(Reported by Harry Faber,* Editorial Associate, *Water & Sewage Works.*)

Surface Wash

"Experience with Surface Wash System at Milwaukee" was presented by **H. C. Schmitt,** Asst. Supt. of Filtration, Milwaukee.

The Milwaukee filtration plant has 32 filter units equipped with a stationary grid surface wash system composed of parallel pipes placed 18 inches apart. These pipes, as installed, were provided with a total of 120,000 orifices. Each year the filter units are drained, the troughs are cleaned, and the sand is inspected. The surface wash system operated efficiently during the first two years, except for some clogging of orifices—a condition which was corrected by maintaining pressure on the system throughout the washing operation.

And More Programmers

E. M. Griffith
Dist. Engr.
Racine

Dewey Johnson
Engineer
C.I. Pipe Res. Assn.
Chicago

After two years of operation, however, rapid erosion of the metal surface of the pipes, immediately surrounding the orifice, became apparent in a large proportion of the pipes. As this condition occurred, the efficiency of the wash water system decreased rapidly. Consideration was given to replacement of the entire piping system, to the use of inserts from the holes, and to the substitution of nozzles. Tests were made of Babbit metal inserts (drilled with holes of the same size), crushed into place; on accelerated testing, these showed even more rapid erosion. Various shapes of nozzles were designed and were made in the plant machine shop. Tests of these indicated erosion would occur only on the tip surrounding the orifice and if the tip were small in diameter, this would not be serious.

On further investigation, it was

*Research Chemist, The Chlorine Institute, New York City.

learned that standard Alemite oil fittings, with properly drilled one-eighth inch holes, would serve perfectly as nozzles. The Alemite company agreed to furnish the necessary 120,000 of these fittings, and the procedure required for removing pipes, tapping, threading and painting on an assembly line basis was worked out. Eleven men of the plant crew were able to complete the work on two filter units each week. The job was done at a cost lower than any other method considered (each fitting cost 3.2 cents) and it is expected that from 10 to 20 years' service will be obtained from this new installation.

Cost of Water Plant Operation

On the matter of "The Cost of Operating Water Treatment Plants," **K. V. Hill**, of Greeley and Hansen, Engrs., Chicago, said it is impossible to divide the costs between personnel and purification.

Items which affect the cost of purification are quality of supply, location of intake, plant capacity, quality of plant design, skill and attention to duty of operators.

Making his survey of three types of source—lake, surface, and well—Mr. Hill concluded that under the item of quality of supply, river waters are worst, and that the design of the intake was important where shifting sands or manganese in reservoirs may affect the supply.

Data on seven lake water plants of 0.5 to 49 mgd. capacity, the cost of operation (chemicals, personnel, maintenance and supplies, and operation) varied from $4.50 to $22.60 per mil. gal. with no particular relation between pumpage and cost.

Four river supplies in as many states likewise showed wide variations (from $6.77 to $32.80 per mil. gal.). In this case, however, the cost varied inversely as the volume pumped.

Only two impounding reservoir supplies were included in the study. In one the cost was $14.40 and $17.60 per mil. gal. for 1944 and 1945, respectively, while in the other the cost was $20.40.

Data on operating personnel were tabulated as follows:

Size of City	No. of Employes per 1,000	Annual Salaries Total	Per Man
Under 20,000	3.66	$8,500	$2,350
20,000-50,000	4.58	9,400	2,050
Over 50,000	6.40	14,700	2,300

Chemical costs per million gallons were as follows:

Great Lakes	$ 2.48- 4.11
Rivers	12.85-14.50
Reservoirs	4.00- 5.08

With this excellent start, it may well be wished that further data may be included in this study.

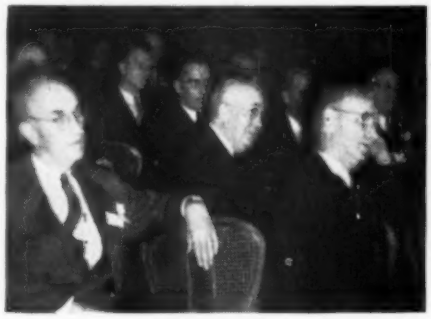
Chlorination

"Modern Practices in Water Chlorination" was the title of the paper by **Harry A. Faber**, Research Chemist, The Chlorine Institute, Inc., New York, N. Y.

A review of chlorination practices, which have developed during the past five decades, makes it apparent that a simplified and more exact terminology is now required. Mr. Faber described the study given to this problem by the A. W. W. A. committee in preparation of the forthcoming edition of the "Manual of Water Works Practice." According to the new concept proposed, all chlorination processes can and should be classified on the basis of the type of residual chlorine which results.

There are but two types of chlorine residuals: free available chlorine and combined available chlorine. The means of utilizing standard chlorination practices to produce such residuals were described. Development of these modern practices was possible only after suitable control tests became available, and the ortho-tolidine-arsenite test appears most suitable for this purpose. Free residual chlorination and combined residual chlorination are each especially suitable for specific purposes in water treatment. Some of the advantages resulting from controlled applications of such treatment were described.

(Ed. Note: Mr. Faber also discussed the reactions of chlorine in water, the mechanism of chlorination, its control, and introduced each section of his talk with an appropriate philosophical quotation.) James Kerslake of Milwaukee presided over this session.



Chlorination Practices

The Audience — *Recognizable in rapt attention, Leon Smith of Milwaukee and Harry Jordan of A.W.W.A., and (behind) Herb Brown of Milwaukee.*

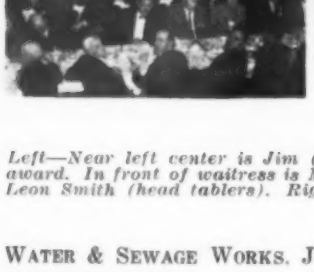
The Speaker — *While Jim Kerslake presides, Harry Faber (Chlorine Inst.) expounds on a humorous point.*

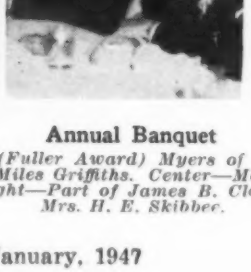
GROUND WATER

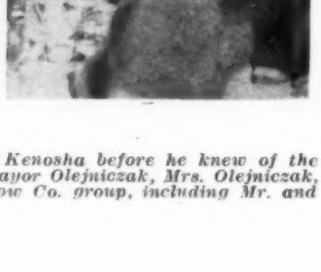
Under the presiding of Verne Somers, Stevens Point, the session on ground water covered supplies and softening.

"Ground Water Studies in Wisconsin" was related by **Frank Foley**, U. S. Geological Survey.

Mr. Foley described the benefits which have followed close cooperation between the State Geological Survey, the State Board of Health, and the Soil Conservation Service with the Federal Survey in these studies. The war years accelerated declining ground water levels which had already shown such a trend prior to 1942. In 1945, legislation made possible the cooperation of the State University with the Geological Survey in a joint investigation. Mr. Foley reviewed the geology of Wisconsin, described studies underway in the southeastern areas







Annual Banquet

Left—Near left center is Jim (Fuller Award) Myers of Kenosha before he knew of the award. In front of waitress is Miles Griffiths. Center—Mayor Olejniczak, Mrs. Olejniczak, Leon Smith (head tablers). Right—Part of James B. Clow Co. group, including Mr. and Mrs. H. E. Skibbee.

where the problem is most serious, and requested the assistance of all those individuals who can provide continuous records of ground water levels.

Water Softening

"Economic Aspects of Water Softening," by **William Gallaher,** Supt., Water Dept., Appleton, and **H. F. Weckwerth,** Supt., Water Dept., Kaukauna, Wis., was a joint paper in which the authors brought to light certain troubles which might be encountered when municipal softening is undertaken, and stressed other factors not generally considered. In the lime softening process, the cheapest method for removing bicarbonates of calcium and magnesium, clarification of turbid waters can be accomplished simultaneously. But there is a limit to the turbidity which can be removed by this process, and it introduces the problem of lime sludge disposal. Bactericidal action of the lime constitutes another advantage in this process.

Conversion of the Appleton municipal clarification and filtration plant to a lime softening plant in 1942 required an expenditure of about $20,000, and the operating cost was increased about $4,000 per year or about 14 cents per capita. Approximately 40 per cent of the original water hardness is removed. Sulfate hardness is more costly to remove since soda ash is required when the lime softening process is employed, and salt is required when the zeolite softening process is used. Since the use of soda ash complicates a chemical treatment process, waters high in sulfate hardness may generally be softened most economically by the zeolite process.

An unusual ground water condition exists in the Kaukauna area, where water hardness increases with the depth of the well, but where the increase in hardness is due almost exclusively to sulfates. In increasing the capacity of its well supply, the City of Kaukauna decided to limit the depth of new wells to 550 feet and to fill an old well (now 773 feet deep) to the same level. By this procedure, water of half the present 41 grain per gal. (700 ppm.) will be obtained. The savings effected from softening water of lower hardness would amount to 2.38 cents per thousand gallons. In adopting municipal softening, it should be borne in mind that the increases in rates required to pay the costs of softening apply to industrial consumers as well as to domestic users, while the latter may receive the greatest benefits.

The authors discussed several objections to softened water, notably greater corrosivity and its high pH value. They reviewed the advantages and disadvantages of home softening units, comparing relative costs of the two methods. While municipal softening is beneficial to consumers, it results in a larger number of maintenance problems.

Wisconsin Ground Waters

In "Ground Water Supplies of Wisconsin," **H. E. Wirth,** State Sanitary Engineers' Office, Madison, Wis., presented a comprehensive review of data based on studies now underway to determine the chemical characteristics of the ground water supplies of the State. Some of the data: Of the 539 supplies now analyzed, 70 per cent have objectionable hardness; only 14.5 per cent contain iron in excess of 1.0 ppm.; only 5 per cent have objectionable quantities of manganese; 5 per cent have over 1.0 ppm. fluorine, but 2 per cent contain an optimum of 1.0 ppm. fluorine. The wide range of chemical composition which exists in various supplies was illustrated by citing two communities—one lowest in total solids (42 ppm.) and the other highest in total solids (1,356 ppm.)—which represent the extremes found in the State. Only five times in the entire history of the State has there been a record of water-borne disease. Mr. Wirth cautioned against believing the depth of well supplies offered any protection against pollution.

Entertainment
Father and daughter team of comic acrobats.

DISTRIBUTION

The final session held on Sunday morning was devoted to the discussion of distribution systems and was presided over by **James Myers,** Kenosha, Wis.

Main Sterilization

E. M. Griffith, Distribution Engineer, Racine, Wis., made no effort to present a complete survey of "Sterilization of Water Mains," but he did tell a highly interesting story about several experiences he had had in Racine. Based on this experience, Mr. Griffith is of the opinion that no hard and fast rule can be laid down for main sterilization.

The instances referred to in the paper were in connection with the installation of new mains in different locations and of different lengths. One consisted of 860 ft. of 6-in., one was 1307 ft. of 6-in., and a third was of various lengths of 8-in., 12-in. and 16-in.

To sterilize the sections of pipe, a 21-ft. length of ¾-in. pipe was fitted at one end with a hose connection and a drilled pipe cap placed on the end to form a spray nozzle. This spray was used to spray the inside of the pipe with a solution of 200 ppm. of available chlorine in hypochlorite solution. Dirty pipes were washed out and swabbed out first. Joints and packing rings were cleaned in the same solution.

In one section of main, when the original filling with water was sampled, the count was 5000 per ml. and the gas formers were 2/5. Flushing followed by 36 hour standing and sampling indicated 450 bacteria per ml. A third flushing and the count was down to 70 with no gas formers.

On another section of 12 and 16-in. pipe, samples taken after the filling water was flushed out indicated no gas and less than 8 bacteria per ml.

In another section although the filling water was dosed with 15 ppm. of chlorine water, it appeared that none really was needed as there were no coliform and counts were 7 or less.

Mr. Griffiths recommends the following procedure for main sterilization in preference to the use of dry powder in each section and in preference to liquid chlorine solution. A solution of hypochlorite, purchased as such, is injected into the main with a small proportioning reagent pump. A continuous feeding pressure pump will do away with the one disadvantage of this system, namely, that uneven diffusion is obtained.

Continuous addition of sterilizing agent in small amounts as water is passed through the line is also recommended.

One experience in main sterilization or lack of it is of considerable interest. A six-inch main (about 0.6 mile) was laid in a subdivision by the realtor. Half of the main was in sandy soil, the other half in a swampy section which received septic tank drainage.

The section in dry sandy soil required five sterilizations over a period of one and one-half months before it was safe. In the section in swampy soil (all joints were caulked with jute) the story was far worse. After five chlorinations, the count had been knocked down from 15,000 to 250 and the gas formers were absent, but microscopic slides indicate dangerous bacteria.

In this case, everything was tried. Chlorination with from 1 to 150 ppm., contact periods from four days to three weeks, excess and continuous flushings, and chlorine dioxide. This latter was added in the continuous dribbling method, a new procedure in main sterilization. In three months' time the cost of sterilization had reached $731, or 23 cents per foot, and still the ultimate result was not accomplished.

This experience alone is enough to emphasize the merit of main sterilization in advance.

Water Waste Surveys

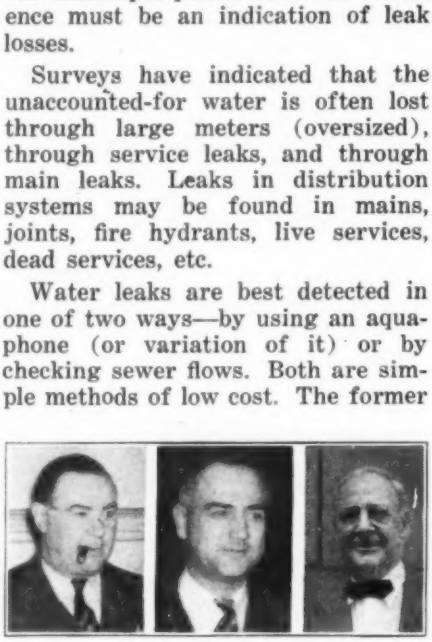
In discussing "Losses and Unaccounted-for Water in Distribution Systems," **Dewey Johnson,** Engineer, Cast Iron Pipe Research Assn., said that the losses and unaccounted-for water throughout the country total a staggering amount and mean a waste of chemicals, power, and labor that adds nothing to the economic growth of our cities.

Whereas most water works speak of "percentage of water unaccounted-for," it would be better to consider "percentage of water sold." In a highly efficient water department, the amount of water sold should equal 85 per cent of the water pumped. This allows for a certain amount of free service water for community use (fires, street flushing, etc.). Many cities, however, actually sell only 50 to 75 per cent of the water pumped and most of the difference is actual leakage.

Because of the practice of using water works income for general funds in many cities, water works superintendents develop a don't care attitude toward efficient operation and low loss of water. It is obvious that inasmuch as private water companies have a per capita consumption of 63 gallons against 115 gallons for municipal plants that the difference must be an indication of leak losses.

Surveys have indicated that the unaccounted-for water is often lost through large meters (oversized), through service leaks, and through main leaks. Leaks in distribution systems may be found in mains, joints, fire hydrants, live services, dead services, etc.

Water leaks are best detected in one of two ways—by using an aquaphone (or variation of it) or by checking sewer flows. Both are simple methods of low cost. The former



Snapped At The Meeting

Philip G. Price, R. W. Sparling Co., Chicago
Geo. Martin, Supt. Sewage, Green Bay, Wis.
W. T. Birch, Birch Mfg. Co., Chicago

depends on the sound vibrations caused by the passage of water through the hole in the pipe or service; the latter depends on visual or measured observation.

Even in the hands of inexperienced operators, the cost of the aquaphone leak detection is low, in one community running but $30 per thousand population. In this instance 67 leaks were located in service pipes between the service box and the house, and 26 leaks in the lead connection to the service box. This particular suburb of a large city raised its accounted for water from 50 to 84½ per cent.

The first time a survey is conducted, it may be necessary to go over the street two or three times to catch all of the leaks with an aquaphone, as the loud leaks will drown out the smaller ones.

Large losses through broken mains or joint leaks may go undetected because the water gets away to the sewer, particularly if the sewer is laid down the street near and below the water main. In addition to house to house canvasses, it is well to look under railroad crossings, at rivers, canals, etc.

One simple method of locating leaks is known as the dew-frost method. It requires that the observer arise early to watch the dew or frost disappear from the pavement. Spots of disappearance generally mean a water leak. In large cities most of the leakage will be from broken or leaky mains, but in small cities the majority of leak losses will be in service leaks.

Pitometer measurements are an excellent means of determining and locating leaks in a distribution system. This method requires the operation of all of the valves in the city, a good thing in itself, and must be done at night when flows are at a minimum.

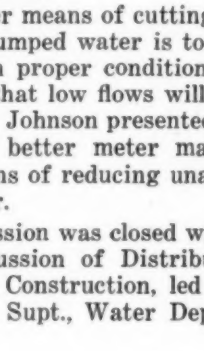
Even with the best equipment, it may not be possible to locate the exact position of the leak, and several test holes may be required, but with practice a crew becomes more proficient and wrong locations become less frequent.

Another means of cutting down on loss of pumped water is to maintain meters in proper condition, particularly so that low flows will be measured. Mr. Johnson presented a strong plea for better meter maintenance as a means of reducing unaccounted-for water.

The session was closed with a general discussion of Distribution Design and Construction, led by R. E. Cannard, Supt., Water Dept., Manitowoc.

"Tommy" Hodkinson Retires

Longtime Supt. of Water Distribution for London, Ont.



Thomas Hodkinson, Superintendent of Water Distribution for the Public Utilities Commission of London, Ontario, retired on December 1.

Known to his many friends as "Tommy," Mr. Hodkinson has been in the employ of the Commission for 42 years, most of that time in his recent position.

Mr. Hodkinson is a veteran member of the Am. Water Works Assn. for 34 years, a consistent attender of its meetings and one of a group responsible for organizing the virile Canadian Section.

RECORDS—THEIR VALUE IN WATER AND SEWAGE WORKS

By A. E. CLARK
Dept. of Public Works
NASHVILLE, TENN.

THE value of accurate, well kept records in water and sewage works cannot be overemphasized. Data worth the trouble of obtaining are worth the small additional trouble of recording. It is true that information often loses its value after it has been obtained, but it is well to be sure, before it is destroyed, that the data may not be useful at some future time.

If a survey were made of the records in a large number of plants of various sizes, the variety, scope, and manner in which kept, would be amazing. Some would have few records, others too many, and still others between these extremes.

Water and sewage plants are comparable to industrial plants which have systems of records reflecting the operations of industry. Keeping records in industrial plants is considered good business. Why should not water and sewage works follow the practice of good business?

Records in water and sewage works have a very definite place in the operating procedure of the plants. They have historical as well as current value, but records containing inaccurate data are valueless whether the data concerns operation or equipment maintenance and performance. As an example of inaccurate data, the writer may cite a happening in his own plant. In spite of careful training of personnel with reference to certain pressure gages, one operator gained the impression that the reading should be recorded the same each hour, on the record, although a normal variation in gage readings was to be expected. This operator's records were obviously out of line with the records of the other two shifts. Needless to say, the recording of inaccurate readings was corrected, but this experience shows that inaccurate data can be recorded with the best of intentions.

Laboratory Records

Some records are essential, others less so. Some provide information, others provide useful information. The results of laboratory analyses should be recorded, accurately, of course, on printed forms designed to suit the particular needs of the plant.

The Author

There are no standard forms, inasmuch as the function of each plant may be different as, for example, one plant may soften water while another may have a pollution problem either bacterial or industrial with which to cope, and the forms needed will be different for the two plants.

Before the final forms are printed, it is well to experiment and try out forms, either mimeographed or black line prints. Changes, deletions, additions, and so forth, may be worked out on these temporary forms and worked into the final form. Space should be left for the signature of the employee making the report.

There are routine tests made daily, others made weekly, and other tests may be made at indeterminate intervals. The routine tests may be recorded on the daily forms, while special work should be recorded on a small general form carrying laboratory number, date, etc. This type of work is not usually carried on the monthly report sheet, but is handled as a separate report. Some of the data recorded on the daily form are also not reported on the monthly form, therefore it is necessary to have both daily and monthly forms. The monthly report should have space for recording totals, maximums, minimums, and averages, or median. These data provide for a quick survey of the operations during the month.

Plant Operating Records

Some thought should be given to the arrangement and data to be recorded on the daily log sheets as well as the monthly report forms. As with the laboratory records, it is well to make up preliminary and temporary forms for trial before the final forms are printed.

Daily operating logs usually should provide for data from three shifts, and space should be left for the signature of the employee in charge of each shift. Practice varies, but routine readings are usually made each hour, while readings of meters, quantities of chemicals, etc., are taken at a specific time each day. Forms may be made so that the hourly reading is shown on the line corresponding with the hour shown in the left hand column of the form, under the proper heading. Space may be left at the bottom or right hand side for meter readings, chemical quantities, etc.

If possible, the collection of the data to be recorded should take the operator to all parts of the plant, to insure a check-up at least once an hour. Space should be left for remarks on trouble, or unusual happenings on the shift. Log sheets in pumping stations should provide space for the operating times of pumps.

Records on pump operation can prove very useful if carried forward as a total to each daily log sheet. If four or five pumps are being used, then the operating time of any pump is known at a glance for any period of time. The writer found this practice helpful in checking the operating history of the bearings of certain pumps. These records showed that the bearings had a life of only 60 per cent of that expected.

The monthly report need not necessarily contain all of the data on the daily reports. Also, depending on the type and size of the plant and the disposition of the monthly report, the laboratory and operating data can sometimes be combined in the monthly report. If the combined form is too large or cumbersome to file, it may be better to make two monthly report forms.

Meters that register, indicate or record for 24-hour periods usually have 24-hour charts of operation. These provide useful information and should be filed so that they may be readily examined if desired. The writer found these particularly advantageous in one instance when it was desired to learn the time of a

main break and the time of restoration of service. The raw water meter chart gave the precise times as shown by the variation in pumping rates and the return to normal flow.

Equipment Records

A record of all operating equipment is a very handy thing to have. This record can well be kept on file cards and filed under the classification of equipment to which it belongs, such as pumps or chemical feeders. On the card should be recorded the same data that appear on the name plate on the piece of equipment, capacity, head, rpm., voltage etc., as the case may be. Where more than one piece of identical equipment exists, each should have its own number designation in the files and painted on it. On these cards, too, may be recorded the information on repairs, replacements, etc.

Inventory Records

An inventory should be taken of tools, spare parts, pipe and fittings, gages, etc. This inventory should be kept on current file cards. Setting a maximum and minimum quantity for each item aids in keeping the inventory at best operating conditions. For example, if the inventory card shows a maximum of six of some item and a minimum of three, then an order for three of the items can be placed when the inventory drops to three. The maximum and minimum numbers may best be determined from operating conditions and needs and from consideration of shipping conditions.

Most manufacturers will provide a list of spare parts necessary for their particular equipment. It has been found that the manufacturer's recommendations are conservative and do not suggest a long list of items that will never be needed during the life of the equipment.

Personnel Records

Municipalities and industries having a personnel department keep a record of all employees but a much less elaborate record may prove useful, at times, in a plant. These records can also be kept on small file cards giving the name of the employee, date reported for duty, address, telephone number, or where he may be reached if he has no phone, classification, and dates of change in classification, and date and cause of leaving or dismissal if dismissed. It is often advantageous to have this information available at the plant as well as in the personnel department records.

Diary or Log Book

Unlike personal diaries, the diary or log of a water or sewage plant should not be kept under lock and key. It should be a simple diary or log book for the supervisor to record the unusual happenings in the plant during that day. It is surprising how often a diary of this type will answer questions which arise six months or a year later.

It may be only a casual entry in the diary, but this would possibly lead to the examination of other records on this date and thus give the complete information requested. Weather and temperature recorded at a specific time each day may be a regular entry, whether or not it is also kept with the laboratory data.

Many other records may be kept covering some specific operation in a plant. The number and type of these records depend on the plant as well as the supervision. It is well to remember that one can easily have too few records, but it is difficult to have too much information.

WATER AND SEWAGE PATENTS

(Of Recent Issue)

WATER PATENTS

Fluid Meter. Alexander R. Whittaker (to Rockwell Mfg. Co., Pittsburgh, Penna.); U. S. 2,410,852; Nov. 12, 1946 (Appl. 5-22-42). A water meter of iron body and iron frost plate with measuring chamber made of rustproof material.

Fluid Metering Apparatus. Albert J. Granberg, Oakland, Calif.; U. S. 2,411,261; Nov. 19, 1946 (Appl. 6-17-42). A fluid meter with means for air separation.

Apparatus for Clarifying and Purifying Liquids. Henry C. Parker and Frank D. Prager (to Graver Tank & Mfg. Co., Inc.); U. S. 2,411,386; Nov. 19, 1946 (Appl. 2-3-43). A tank for liquid clarification comprising a flat circular tray concentrally and horizontally installed between bottom and top of the tank, spaced from the wall and having a central opening to form a flocculation compartment below said tray and a clarification compartment above the tray. Impeller in lower compartment to aid flocculation, upward flow to aid clarification and all appurtenances.

Liquid Treatment. Frank D. Prager (to Graver Tank & Mfg. Co., Inc.); U. S. 2,411,390; Nov. 19, 1946 (Appl. 4-3-44). An upflow coagulating and clarification tank.

These patent abstracts being brief do not necessarily cover the entire scope of the invention described. If the reader becomes especially interested in any of these patents he should obtain printed copies of the complete patent, at 25 cents each, from the Commissioner of Patents, Washington 25, D. C.

Corrosion Protection of Metals. Willis G. Rouston (to Shell Development Co., San Francisco, Calif.); U. S. 2,411,593; Nov. 26, 1946 (Appl. 8-11-43). A corrosion preventive composition made from a hydrocarbon fraction and a finely dispersed amount of corrosion retardant consisting of an organic monobasic acid of 10 to 60 carbon acids and containing a radical consisting of nitrile, nitro, and nitroso radicals. Also a variation of this composition using a small amount of dicarboxylic acid containing at least 16 carbon atoms.

Apparatus for Continuous Clarification. Jose Ramon Osuna, Marianao, Cuba. Re-issue 22,814 (Orig. No. 2,307,154, Jan. 5, '43), Dec. 3, 1946. An apparatus for continuous clarification with upward flow and several chambers for flocculation and clarification.

SEWAGE PATENTS

Sanitary Field Latrine. Charles C. Martin, Savannah, Ga. U. S. 2,410,092; Oct. 29, 1946 (Appl. 9-14-44). A portable and knockdown field latrine.

Pump. John Mann (to Gould Pumps, Inc., Seneca Falls, N .Y.); U. S. 2,413,416; Dec. 31, 1946 (Appl. 12-6-43). A centrifugal pump.

Compound Motion Fluid Distribution Valve for Wabbler Plate Meters. David S. Willson (to John Wood Mfg. Co., Inc., Philadelphia, Pa.); U. S. 2,413,670; Dec. 31, 1946 (Appl. 12-23-44).

FALL MEETING N. J. SECTION AT ATLANTIC CITY

Joint Meeting with South Jersey Water Superintendents

MEETING in Atlantic City, where the Boardwalk, the seafood and the sea are extra added attractions to any convention, the New Jersey Section A. W. W. A. held its Fall meeting in conjunction with the South Jersey Water Superintendents on Nov. 7-8-9.

Business

There was no business session, but at one of the sessions the group adopted the following resolution:

"Whereas the N. J. Water Policy Control Commission now has no control over industrial water supplies, and whereas such control will afford mutual benefit to both municipalities and industries with existing water supplies and will protect both municipal and industrial water supplies from encroachment by new industrial or municipal supplies;

"Therefore, be it resolved that this session of the N. J. Section, acting as a business session, hereby go on record as favoring and strongly recommending that the State of New Jersey enact such legislation as the Water Policy Commission shall prepare for the purpose of placing all water supplies, be they municipal or industrial, surface or ground, under the control of the Water Policy Commission."

Fuller Award

Completely unaware that he was to receive the Fuller Award, the awardee was absent from the annual banquet and had to be sought in order to receive this citation:

"It seems fitting that the Fuller Award Committee of the N. J. Section should choose as its nominee for the honor one who has devoted his life to education—**Professor Harry N. Lendall.**

"Harry, as he is known to us, is Head of the Department of Civil Engineering and Professor of Municipal and Sanitary Engineering, College of Engineering, Rutgers University, New Brunswick, N. J. He joined the A.W.W.A. in 1923. He was active in the formation of the New Jersey Section of the Association, served as Secretary-Treasurer for several years, and as director from 1941 to 1944.

"For many years he has played a prominent part in conducting short water works schools at Rutgers and his contributions to the advancement of the water works profession, through the technical press, are many."

Fuller Award
Harry N. Lendall
Prof. San. Engr.
Rutgers Univ.
New Brunswick, N. J.

To The Winnahs!
Charlie Bushnell and Bill Flanders and the rest of the table really sang—W. J. "Bill" Orchard makes the award.

Technical Sessions

Presiding at the first session was **Roswell P. Roper,** Engineer, Manager of the East Orange Water Co. At this session a sound slide film reporting recent advances in concrete technology was presented by **Ralph Crimm,** The Master Builders Co., Cleveland, Ohio. Boyd A. Bennet, Pres., Water Utilities Service Corp., N. Y. C., introduced and directed a general discussion of "Labor Relations," and Clyde Potts gave the report of the Section's Water Supply Committee.

At another session, H. R. Cady, Mechanical Engineer, Hackensack Water Co., New Milford, N. J., presented a talk on "Developments in Pumping Practices." This was followed by Commissioner Frank Miller, North Jersey District Water Supply Commission, Wanaque, N. J., and his discussion of the "Proposed Ramapo Addition to the Wanaque Water System."

Question Box

Directed by Charles Bourgin, Supt., Montclair Water Bureau, Montclair, N. J., the Question Box took up such questions as operation of cone valves; rustproofing materials and what they are; two main systems and the advantages thereof; and cement lining of pipe. It was reported at this meeting that experiments are now being conducted on the lining of small size pipe, one inch and less.

Merrill Bernard, Chief, Division of Climatological and Hydrologic Services, U. S. Weather Bureau, Washington, D. C., discussed the "Cause of Rainfall Excesses and Deficiencies in New Jersey." By means of graphs Mr. Bernard showed the movement of air masses and their effects on weather and said that statistical forecasting was a coming development and awaited only the installation of calculating machines, which the speaker said would be installed by the government when water works men made it plain that such information would be of great value to the operation of water supplies.

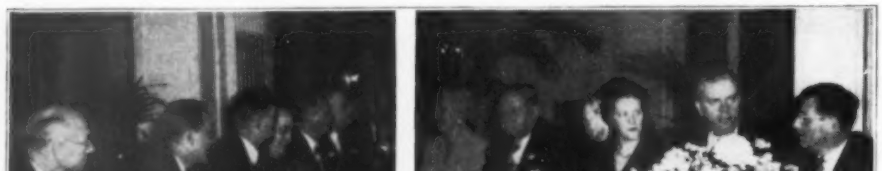
High Costs and Water Rates

In introducing the discussion of "High Costs and Their Effect on Water Rates," Charles J. Alfke, Executive Vice President, Hackensack Water Co., Weehawken, N. J., Mr. Alfke referred to the paper by L. R.

The Spellbinder
N. T. Veatch, Vice Pres., A.W.W.A.—The charming Mrs. Veatch at his left.

Howson, presented at the A.W.W.A. meeting in St. Louis (this article was also published in the June, 1946, issue of *Water & Sewage Works*). Three questions asked by Mr. Howson were these: How much new capital is needed to finance new projects for the next decade? What 1946 rates will pay for this construction? Is it necessary to increase rates now and how much?

Mr. Alfke pointed out that operation costs have gone up, but that water rates are more stable than gas and electric rates, and Mr. Alfke suggests that rate changes be deferred until costs are more stable; rates should not be changed now unless it is absolutely necessary, but under no circumstances should rates be lowered now.



Left, Board of Experts for "20 Questions"—Right, Head Tablers
Left to right—Veatch, Carmichael, Spencer, Jordan, Roper, Sheehan, Norcom—Mrs. Roper, Roswell P. Roper, Mrs. E. D. Sheehan, Ed Sheehan (bride and groom), and ?

Forest Management

John M. Heilman, Forester, Newark Division of Water, Newfoundland, N. J., told how the Newark Forest was started in 1906 with Scotch and Austrian pines. In Europe young trees are planted on three foot squares but in this country the plants are set on six foot squares. The purpose of forests is to hold water and to purify water. To keep fires at a minimum it is necessary that the local residents have the proper attitude. Ample truck trails, fire brakes, and picnic areas are helpful in maintaining fires at a low of 0.4 per cent of the area each year.

Conifers hold back snow more than do the hard woods. Most of the trees planted on the Newark Watershed are White and Norway Spruce. Insect and disease control are essential. When trees are planted there are 1,200 to the acre, but in 70 to 80 years this has been reduced to 125 trees per acre. As the trees develop, the weaker ones are sold off.

Superintendents' Round Table

Walter Spencer, Secretary of the South Jersey Water Superintendents, conducted the Round Table at the last session. The first subject discussed was "Pump Maintenance." Sleeve bearings require longer shafts and have more leakage. Ball bearings often use too much grease. Don't use flax packing in pumps where there is high peripheral speed; it causes too much drag. Couplings are designed for perfect alignment; whenever misaligned, there is bound to be wear.

"Storage Tank Maintenance" came in for its share of the discussion, as did "Main Laying Procedures" and "Meter Repairs." "Increasing Well Yields" was discussed by James Harding, Commissioner of Public Works, Westchester County, N. J., who explained what to do in rock wells. Shooting is not satisfactory, but scrubbing has been found helpful. This method, developed by J. Arthur Carr of Ridgewood, N. J., and carried out by Virgil Every, Well Driller, has been successful in increasing well yields.

Mr. Harding also described the use of acid, dry ice, surging and chlorine. Angus D. Henderson of New York City told how screens become plugged with sand, and said that wells should not be developed too fast. For deep wells, Mr. Henderson suggests redeveloping with a surge rig; for medium wells use air pumps for redeveloping; for shallow wells, pump down and charge for 4 to 18 hours. If there is no redevelopment it is probable that new screens are needed. Ten to 12 per cent of the time, wells will be spoiled and new screens will be needed, but in the others one may expect 700 to 2,000 per cent increase in well capacity.

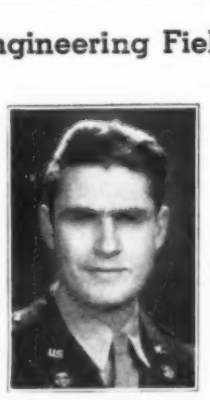
In Illinois it has been found that wells last only seven years or so; they should last from 20 to 30 years. Rock wells should last even longer.

W. T. Ingram Appointed Engineering Field Associate of A.P.H.A. Staff

The Executive Board of the Amer. Pub. Health Assn. has appointed William T. Ingram, formerly Lt. Col. U.S.P.H.S. of Berkeley, Calif., as Engineering Field Associate.

The need for professional leadership in the field of environmental health has been recognized by the A.P.H.A., and the Council of the Engineering Section has undertaken a field project to explore the problems related to sanitary and public health engineering with a view toward the following:

1. More adequate provision of personnel employed in the sanitation of environment.
2. Establishing the engineer in a position of greater importance to the administrator.
3. Developing sanitary engineering and public health engineering as professional careers offering opportunities to young men entering colleges and universities.
4. Stimulating universities to the expansion of undergraduate and graduate curricula which will prepare the student for a professional engineering role.
5. Improving and broadening environmental health services in all the functional fields in keeping with state and community requirements.



Col. Ingram brings to the Association a wide range of experience, including design, construction, surveying, stream pollution, investigations and works maintenance, including experience at local, state, national, and international levels.

Ingram is a member of A.P.H.A., Am. Soc. C.E., Fed. Sew. Wks. Assn., A.W.W.A., and past secretary of the Calif. Sew. Wks. Assn. A registered Civil Engineer in California, Ingram is a graduate of Stanford University, with a master's degree in public health from Johns Hopkins University.

The field project has been underwritten for a period of two years by the National Foundation for Infantile Paralysis through funds from the March of Dimes and by a group of sanitary engineering industries.

PUBLIC RELATIONS IN WATER AND SEWAGE TREATMENT PLANTS

By WALTER A. SPERRY, Supt.
Aurora Sanitary District
AURORA, ILL.

IN THE year 1912 the writer was named the superintendent of the new water purification plant in the city of Grand Rapids, Mich. The Grand Rapids plant proved a distinct challenge in public relations problems as well as a stimulating adventure in operating procedures that lasted for over seventeen years. Out of those experiences evolved a whole philosophy of ways to deal with the public that still today prove highly satisfactory.

At least one-third of Grand Rapids' population were of Holland descent. They were as fine a group of citizens as ever crossed the ocean, but traits of inherent conservatism strongly inclined them to be skeptical of the new fangled plant that was going to put chemicals into their drinking water. In fact, the whole citizen body of Grand Rapids were in doubt. Pleasing as was the sudden change from the raw, turbid, hard, and discolored water formerly pumped from the Grand River to the soft, sparkling, and potable effluent from the new filtration plant, it was necessary to enter into a direct selling campaign to combat prejudice and doubt.

There were constant and repeated questions raised by telephone, at meetings, on the street corners and at the City Hall. "Why does lime make water hard and how does lime make water soft?" "Does not lime coat the stomach as in the teakettle?"

The Author

"If lime is used to decompose dead bodies, is it alright to use it in our drinking water?" "If we use the water to scrub our porches, will it take the paint off?" "I am going to wash my hair; will this new water turn it red?" "We want to water the lawns; will this water kill the grass?" "Why does it take more of this new water to quench our thirst?" These questions and many more were asked for a long time. The questions had to be answered, and answered satisfactorily.

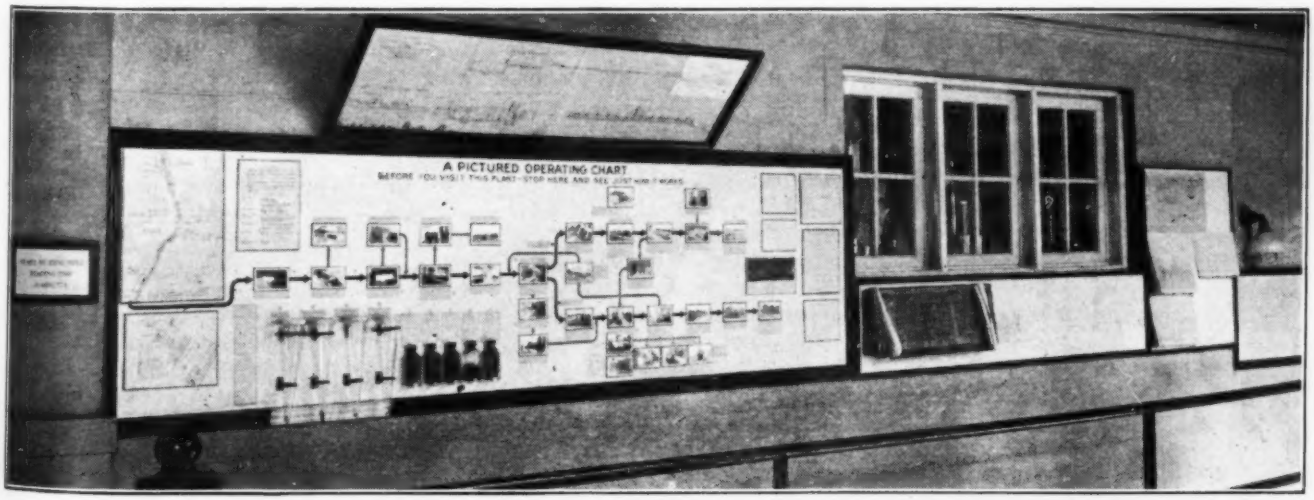
The superintendent was faced not only with the duty of operating the plant but also with the problem of so winning the trust and confidence of the water user that the city officials and other public spirited men responsible for its being financed and built would be fully justified. Of the two problems, that of winning the public's confidence was the more important and the more difficult.

Planned Talks Help

The situation was met by planning talks illustrated by chemical experiments showing how the plant did its work. The process was discussed in easily understandable terms, punctuated with experiments that made clear the use of alum and lime and in such a way as to generally answer all their questions. These talks proved so popular that for almost three years after the starting of the plant there was scarcely a month without two or three speaking dates. Care was taken to state facts, allay fear and solicit confidence. The type of talk was varied to suit the group. Every sort of audience was talked to, ranging from Parent-Teachers' groups to Dinner Clubs and Ladies' Aid Societies. Even the sermon hour in a large downtown church was occupied one Sunday evening.

At the plant, visitors were welcomed but were not allowed to aimlessly wander about. They were carefully piloted around the plant and shown how it did its work with appropriate explanations. In the meantime there was gradually built up a whole gallery of display bottles, charts, diagrams, and records designed to be simple, informative, and helpful. Every effort was made to impress upon the visitor the fact that the plant belonged to him.

The visitor had a right to be there and to ask questions and be instruct-



General Plant Flow Chart with Hydraulic Section Above—Records and Charts Are at the Right

ed in the plant's workings. The plant was continuously visited by individuals and groups and especially on Saturday afternoons and Sundays. Thus there rapidly developed a friendliness for and understanding of its work that gradually dispelled the feelings of doubt which were raised at first. The people met in groups, gathered for instruction, created a wide and friendly acquaintanceship with the plant's personnel that was of the greatest service during the many periods when the plant was not producing a perfect effluent.

One of the most valuable experiences with the public's sufferance with plant operating mistakes occurred soon after the plant was started and is worth relating. The lesson learned in that experience paid good dividends for many years.

Typical Display of Model, Charts, and Pictures at Aurora Plant

One day a strong chlorine taste developed that did not appear generally until near evening. On returning from the theater we received reports of numerous phone calls concerning it, but there had been no chlorine taste at home before going to the theater nor was any noticed after returning. At the plant the next morning, a thorough search of the records for the preceding day was made but no clue as to the source of the taste was found. In the meantime the Director of Public Service had come out to discuss the problem. It so happened that the director was peculiarly chary about any adverse publicity. Shortly after his return to the City Hall one of the plant employees revealed the cause of the preceding day's taste.

Tell the True Story

A large accumulation of lime dust had been removed from the lime storage tower and "saved" by throwing it into the incoming raw water. What escaped attention, at the time, was the fact that there was also stored in the same tower hogsheads of chlorinated lime. The chlorine gas distilling from these hogsheads had been absorbed by the lime, partially converting it to chlorinated lime. The discharge of this material into the raw water resulted in a heavy momentary overdose of chlorine that passed through the plant and water remains in an ever widening circle and so disappeared. Clearly it was an unfortunate accident. At the moment of this discovery the evening paper called for information. Contrary to any advice that surely would have been given by the lately departed Service Director, the full and complete story of the accident was given to the press. The story came out that evening with all details correctly stated.

It is certain that this early demonstration of the policy of a full and complete explanation of the reason for undesirable blemishes in the quality of water being delivered was highly beneficial. Such a public confession given to the newspapers was based on the fact that the plant belonged to the whole citizen body, who had the right to know the truth about their drinking water supply. Moreover, the plant was a complicated machine, and it was not humanly possible to operate perfectly every single day of the year.

Occasionally, try as one might, accidents would happen. All reasonable persons would recognize this fact. If news releases failed to recognize this fact, denied the presence of trouble or failed to give reasonable explanations, the public would quickly sense deception and lose confidence in the plant and its personnel. Therefore, by adopting the policy of careful and truthful explanations of faults, confidence and trust were built up. Time and again citizens calling to ask "why trouble" would usually leave the telephone with an apology for disturbing us, confident that the trouble would soon be in hand. The incident is related fully because it is a valuable lesson in public relations based upon a sound philosophy, the operation of which was tested to the writer's satisfaction for many years.

While this paper is being written primarily for the benefit of the sewage plant operator, it is clear that the problems of both water and sewage treatment plants are the same. The lessons learned through twenty years of water purification plant operation are equally applicable to sewage plants. The sewage plant superintendent should clearly understand and accept the fact that his work as superintendent includes an obligation to interest and inform the citizens of his community. Plant superintendents, therefore, should plan devices for the benefit of visitors that obviously indicate his welcome and right to visit.

Ability to Speak, Important

One of the prime requisites of a superintendent is too often neglected. It ranks almost equally with technical skill, and it is the ability to speak and write good English. It takes time and mental effort to reduce a technical description of a process to a short, easily understandable statement that will convey meaning to a layman. This kind of skill is required to properly set up a visitors' leaflet or to phrase the explanatory signs and notes which may be posted about a plant for visitor guidance.

There is always a thrill connected with the ability to explain the mysteries of a plant's operation to a visitor. The writer well remembers the little old lady from Iowa who mostly raised chickens and who was being shown through the plant one day. Half way through she beamed on him with sparkling eyes, exclaiming, "Why I am really understanding it." No better illustration could be given as to the truth of the theme of this paragraph.

The capacity to speak acceptably

before dinner clubs and at public gatherings is almost without price. If the topic assigned has been presented in clear, simple, logical, thought provoking language, there will be marked attention—always a compliment. There will also be an implied pride in the possession by the group of a plant so represented. Furthermore, there will be an undue assignment of skill to the speaker—very possibly undeserved—because this is the way clear, forceful speaking affects an audience. Because, through the years these principles have been demonstrated, the ability to write and speak is re-emphasized.

Fill Bare Spots on Walls

Bare spaces on the walls of a plant have always been a challenge to fill them with a variety of instruction charts and diagrams. The planning of instruction exhibits can easily become a pleasant and profitable hobby. All they require is a good idea combined with a modest ability to draw and a knack for developing an idea for quick and easy understanding. When neatly framed or mounted they accumulate gradually into an attractive gallery for public instruction. Do not be discouraged, however, if they are not always studied too carefully by John Citizen. They still perform a useful purpose. They make bare walls attractive. They indicate a personnel interested in the work of the plant and therefore persons who likely are faithful public stewards. Whether the visitor cares to take the trouble to understand them or not, they are mute evidence that his interests are being cared for. Finally they are a challenge to the operator himself to maintain a high standard.

To illustrate the variety of exhibits that can be planned to make the visiting of a plant interesting, the following list of displays at Aurora are given:

Framed Ground Plan showing plant layout. Scale 1 inch equal 25 feet. Dimensions 3 by 3½ feet.

Complete Flow Diagram with pictures of all apparatus accompanied by explanatory notes. Framed board 2¾ by 10 feet.

Picturized vertical section of all structures showing hydraulic gradient through the plant. Framed dimension 1½x5 feet.

Pin map of sewage plants in Illinois.

Pin map of all cities over 1000 population having sewage treatment in the United States framed 2 by 3¼ feet.

Map of the Fox River with pictures and notes of the twenty-three plants located on the river.

Glass fronted model of the sprinkling filters showing a full scale section.

Accumulating file of the regular monthly data sheets showing all chemical and physical data and posted monthly.

17 framed groups of pictures of plants elsewhere.

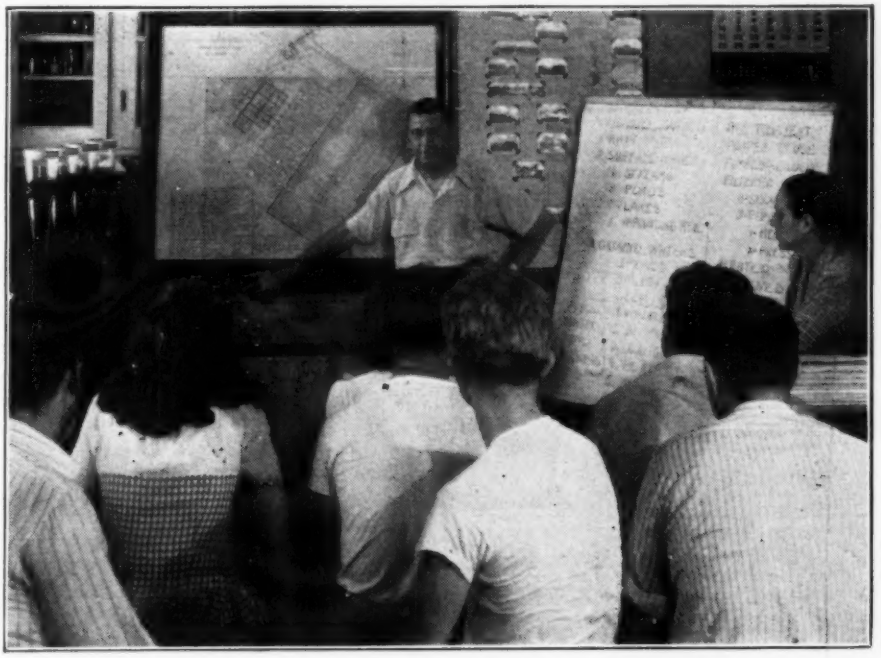
Current year curves, added to monthly, showing:

A. Gas production and distribution.

B. Suspended solids and 5-Day B.O.D. data with per cent removal curves.

C. Oxygen content of Fox River, cfs flow in river and pounds of oxygen demand by raw and effluent sewage with curve of per cent oxygen demand removed by treatment.

Curves showing typical hourly flow of sewage to the plant for each day of the week together with the hourly load of suspended solids and 5-Day B.O.D. load carried.



Aurora College Class in Bacteriology Sitting Through a Typical Class Session
The lecturer is Professor Walter A. Sperry.

A series of framed statements placed at appropriate places about the plant to explain that portion. These enable the visitor to follow the process step by step. For details of wording see *Sewage Works Jour.*, Page 380, July, 1931.

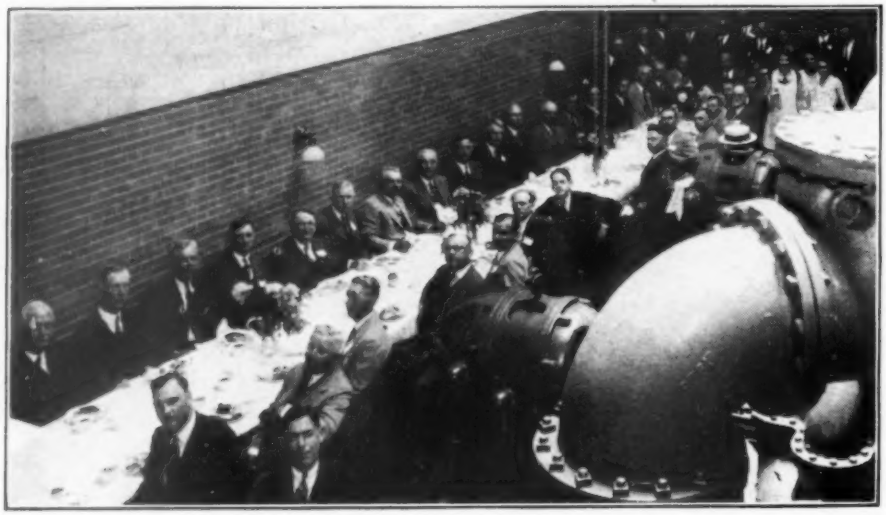
The general mechanics of plant arrangements to receive visitors is completed by providing a descriptive leaflet. While the collection of such material in the writer's files takes many forms as to size, style and type of printing, cost and general elaborateness, a simple four page leaflet, half letter size, is preferred. A good form of leaflet should have an attractive plant picture, a well planned flow diagram and plant layout, a simple, well worded description of the plant, the process employed and a few well chosen statistics. Such a leaflet printed on good paper can be made attractive enough to tempt reading and is quite inexpensive. It makes a pleasing souvenir to terminate an instructive visit. They are particularly useful to complete sessions with school classes.

Conducting Classes Through the Plant

One of the pleasant "must" duties of a superintendent is that of receiving and conducting classes about the plant. For the most part such classes will come from the chemistry departments of the local high schools. Grade schools, however, may send classes, and hospitals will send students in nursing. Groups from other sources may bring the total annual number of such groups up to ten or fifteen. Since the individuals of all such groups are potentially the men and women and therefore the taxpayers of tomorrow, there should be a definite program of procedure to meet their needs. They should be handled so as to favorably impress them with the need and value of this particular unit of the municipal machine. The visit should never be allowed to get out of hand and degenerate into a lark.

The plan adopted at Aurora works well. Classes are received by appointment. They are received, therefore, when it is convenient and with the stage set. Since the period allowed from school is short, the program (which never varies) must be closely timed. Plank benches have been set up in the laboratory to accommodate thirty students. Imhoff cones with raw, clarified, filtered and effluent sewage are on display. The large plant layout plan is in place, together

with the pin map of plants in the U. S. and the map of the Fox River showing pictures of the plants along its banks. Depending on the nature of the class, a series of instruction charts on an easel for quick reference is set up. Thus the class is immediately seated on arrival in a previously prepared place with no chance to scatter. After a half hour of intensive discussion with a short period for questions, the class is conducted through the plant, being careful to follow the sewage flow as previously discussed. Thus the whole procedure is kept on such a high level of serious discussion and interest that disciplining is unnecessary. No class has ever failed to respond to the plan. Nurses' classes, having more time, are given a much longer lecture since their visit to the plant may be their only opportunity of receiving some brief instruction in the field of Sanitary Engineering as related to water, sewage and garbage problems. Aurora has now completed plans for building extension and remodeling. *These plans include the unique feature of a special room fitted up to receive and instruct classes.*



Dinner Meeting in the Aurora Sewage Plant
Close inspection will show several well known faces in sanitary engineering.

An invitation to be the speaker of the day at one of the local dinner clubs is a happy combination of compliment and opportunity. Fortunate is the superintendent that has cultivated a small capacity to meet such a speaking date acceptably. Most clubs contain a good cross section of the business and professional men of the community. These men are quick to appraise a good program. Your date, well filled, thereby becomes a real asset in good will and appreciation. It is certain that if the first club talk is good that invitations will soon come to appear before other clubs. Furthermore, plant superintendents should belong to a local dinner club. It is a sure way to cultivate friendliness and an understanding of his contribution to the community welfare.

Club Meetings at Plant with Meals

As a corollary to a club speaking date an arrangement to have a club meeting at the plant is excellent. Aurora has had several such meetings. They were much enjoyed. Usually some church women's group is glad to prepare the meal. Cooked in the laboratory and nicely served at a sewage plant is a long remembered novelty. The plan may be varied according to the season of the year and the space available. It may take the form of a lawn party with box lunches or a picnic. Either event is a good scheme.

With this is concluded an account of public relations experiences that have proved successful for the past thirty years. The very first requisite for success as a superintendent of a sewage plant is that he should be sold to his job, in the Presbyterian sense of being "foreordained and predestined" to it. The writer feels that most of them are.

A good superintendent will possess at least four personal characteristics. Intelligence—he must be well informed. Friendliness—he must like people and be easy to approach. Patience—to deal with folks that have "gripes." (Most "gripes" result from misinformation. Such people are dealt with by patiently letting them fully expend their spleen, after which they can be reasoned with.) Plain honesty—the superintendent's public must have the sure feeling that their plant is in competent hands.

The physical background for good public relations include:

A—Inviting plant approaches.

B—Well kept and attractive grounds with lawns, trees, shrubs and flower beds.

C—A clean plant. Good housekeeping automatically implies good operation in the eyes of the visitor.

D—A well defined visitors' program. It should include:

1—Some ability to speak and write.
2—A well designed visitors' leaflet.
3—The walls of the plant decorated with helpful and interesting charts, diagrams and pictures.
4—The plant should be posted with short descriptive paragraphs in sufficient number and so placed that a visitor can readily read his way through.
5—A well planned program of procedure for classes.
6—A supply of bottles for samples, a spotlight and interpretive charts and diagrams for use in making acceptable talks before outside groups.
7—If occasionally a dinner club or other group can plan a dinner with an inspection tour of the plant afterwards, it helps.

Oldtime Subscriber Discovered

J. W. Dappert Is Probably W&SW's Oldest Subscriber

During the ordinary course of obtaining information on subscribers to *Water & Sewage Works* it was discovered from a reply card that James W. Dappert, Civil Engineer of Taylorville, Ill., may well be the oldest subscriber both in point of years and point of subscriptions to this magazine.

Mr. Dappert, who is 87 years old and still fairly active, specializes in land drainage. He states that he has been a subscriber to Gillette publications continuously since the Gillette Publishing Company was organized 41 years ago.

Not only is the story of Mr. Dappert of interest because of his long-time association with the field of sanitation, but this is another father and son story. J. W. Dappert is the father of A. F. Dappert, Principal Sanitary Engineer of the N. Y. State Dept. of Health, who is Secretary of the N. Y. State Sewage Works Association, and who also at the last meeting of the Federation of Sewage Works Association at Toronto was elected Director-at-Large.

TRICKLING FILTERS—AN EVALUATION*

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WE ARE now approaching 50 years of experience in the United States in the operation of trickling filters, with experience in England predating ours by about ten years. From a humble beginning at Madison, Wisconsin, in 1901, there are probably in excess of 1000 municipal trickling filters in the United States, not to mention hundreds of plants serving institutions and industries, and those constructed to serve military cantonments which mushroomed all over the United States during the recent world war.

In view of the surge of sewage works construction which can be expected as soon as our post-war economy has become stabilized, it would appear an appropriate time to chart our future course with respect to the design of trickling filters. With construction costs extremely high and with bids exceeding engineers' estimates, a critical look at design standards appears in order, as well as an evaluation of advancing knowledge of factors affecting the performance of trickling filters.

The demonstrated ability of the trickling filter to perform reliably even when subjected to such adverse conditions as wide variations in the composition of the applied sewage, or to sudden shock loads, has given it an enviable place in the waste treatment field.

During the past ten years there has been greatly increased interest in trickling filters which, for a while, seemed destined to assume a secondary role to activated sludge. The development of high rate filters and the introduction of some new practices in the operation of existing standard rate filters did much to spur renewal of interest, as did better construction and operation technics.

Terminology

There is a need for greater standardization of terminology used to evaluate the performance of trickling filters. The assortment of terminology used does not make for uniform understanding of filter loadings or performance. Loadings have been expressed as mgad.; population per acre

The Author

or population per acre-ft.; lb. B.O.D. applied per acre-ft., lb. B.O.D. applied per cu. yd., lb. B.O.D. applied per 1000 cu. ft.; cu. ft. per lb. B.O.D. applied, and lb. B.O.D. per sq. ft. of surface. It is small wonder that some confusion in evaluating filter performance has resulted. The term lb. B.O.D. per acre-ft. has probably emerged as the most common basis for expressing loading of conventional filters, with both lb. B.O.D. per acre-foot and lb. B.O.D. per cu. yd. being widely used as design factors for high capacity filters. While both of these factors are commonly used, the factor "cu. ft. of media per lb. B.O.D. applied" is easier to use. The disadvantage of this latter term is that it cannot be used to directly express B.O.D. removal. An expression for surface loading in terms of flow remains pertinent, and failure to consider the actual B.O.D. of the sewage in addition to total lb. B.O.D. can result in gross misapplication in design.

Design Loadings

There is evidence that trickling filter design loadings have been unnecessarily conservative probably for a number of reasons. The design loadings still in common use had their origin many years ago when it was thought vital to provide intermittent applications of the loading in filter operation, and considerable attention was given to the relative length of the rest periods between dosings. To afford reasonably uniform distribution with fixed-nozzle filters, it was necessary to use rather large dosing tanks in order to maintain the proper relation of head to discharge volume. This practice resulted in dosage rates which were often many times the mgad. design basis which was customarily calculated from average flow.

When rotary distributors increased in use, the dosage-rest cycles were gradually reduced and dosing tanks were generally made much smaller so that intermittent operation would occur only when minimum flows might not develop sufficient head over the distribution nozzles or orifices to produce rotation of the distributor. Despite this improvement in flow distribution which gave much lower actual dosage (loading) rates, design loadings were not appreciably increased, partly due to the natural tendency for conservatism on the part of regulatory agencies which necessarily exert tremendous influence on design practices, and partly due to additional factors which influence filter performance other than loading. It was these factors which needed and have received considerable attention in recent years, particularly since the development of high capacity filters resulted in a general increase in interest in filters of all types.

Allowable design loadings in the several states vary from about 200-450 lb. B.O.D. per acre-ft. The Army loading basis of 600 lb. B.O.D. per acre-ft. was not found excessive when filter media were properly selected and when other design requirements were respected.

Differences in design loadings can be expected between northern and southern areas due to the influence of temperature on filter performance. Performance will be similar during summer months, but the effect of long winters in the northern states must be given consideration.

The Effects of Pretreatment

If filter loadings are to be increased, the first item which should receive attention is that of adequate pretreatment. The condition of the sewage when applied to the filter exerts a tremendous influence upon filter performance. Efficient removal of suspended solids by primary treatment is particularly important to prevent ponding if filter media is small or has suffered disintegration due to weathering. Suspended solids removal by sedimentation is not effi-

*This paper, presented before the Central States Sew. Wks. Assn., June 13, 1946, is here published by permission of the Fed. S.W.A.

cient if the sewage becomes septic. Solids particles become gas lifted and are carried over with the primary effluent. In addition to the attendant odors and the adverse condition of applying a septic sewage to a filter, the suspended solids loading may cause difficulty.

Appreciable quantities of grease may also cause an operation problem unless there is effective removal in pretreatment. Grease causes ponding and tends to retard biologic action by its coating action which may result in septicity in the filter due to exclusion of oxygen from the purifying flora. The grease problem is, of course, at its worst where wastes from slaughter houses, packinghouses, wool scouring, etc., are involved.

Pre-aeration

Effective pretreatment for grease removal has been obtained by provision of 10 to 20 minutes pre-aeration at maximum hourly flow (20 to 40 min. at avg. flow) through specially designed downflow type mechanical aerators which circulate tank contents with very little surface agitation and introduce finely divided air into the sewage causing film rupture and coalescence of grease which is not held in emulsion. The slowly rising, fine air particles result in flotation of grease into a "blanket" at the surface. Some of the grease is also conditioned for settling.

By providing pre-aeration of 30 to 40 minutes at maximum hourly flow, the substantial increase in efficiency of primary sedimentation results indicating that at the longer pre-aeration period flocculation as well as oxidation is an important factor. Primary sedimentation efficiencies in B.O.D. removal increase to above 60 per cent, and a basis of 50 per cent removal through primary treatment as a design point is not overly optimistic in most cases. At Rocky Mount, N. C., B.O.D. removal through the primaries following pre-aeration has been from 69 to 76 per cent according to published data, with suspended solids removals ranging from 73 to 87 per cent. At Webster City, Iowa, B.O.D. removals through primary treatment are 60 to 65 per cent.

In both of these cases, pre-aeration rather than grease flotation was the objective. Pre-aeration in this amount, accomplished by either mechanical aerators or diffused air equipment, will also freshen a stale sewage or prevent the sewage from becoming septic during primary settling, thus constituting an important odor control measure.

In addition to grease removal and a substantial increase in primary sedimentation efficiency, there is the added benefit of applying an influent to the filter which contains dissolved oxygen and aerobic biologic forms. A trickling filter is an oxidizing device and, like activated sludge, its efficiency and loading capacity are impaired if the influent contains anaerobic forms and is not well clarified. This is particularly important in operating filters at higher rates. Present standard filter design loadings are sufficiently over-designed to compensate for stale sewages, but this is an expensive procedure.

The benefits of pre-aeration-flocculation not only result in an applied sewage more amenable to treatment, but the substantial increase in primary sedimentation efficiency results in the need for considerably less filter volume. An increase in primary sedimentation efficiency from 30 to at least 50 per cent results in need for nearly 30 per cent less filter capacity. This reduction in filter volume plus that which can be obtained by the more optimistic design loadings, which appear possible, will help place the standard trickling filter in a better comparative economic position. For this reason the expense of better pretreatment is readily justified through savings in construction cost and reduced operation problems. Also, with better design of primary sedimentation units giving closer attention to inlet hydraulics, velocity of flow, overflow rates and weir rates, a retention period of two hours at average flow (or better of one hour at the maximum flow rates, which should really be the hydraulic design point) should prove adequate.

One other benefit of pre-aeration is that by discharging digester supernatant to the pre-aeration tank, the problem of a poor supernatant is effectively handled by reducing or eliminating its normally adverse effect on secondary treatment. This adverse effect usually results from its either carrying through the primary units or inducing septicity in the primary units—one of the worst "habits" of digester supernatant. Pre-aeration thus acts as an effective supernatant treater.

Filter Media

Care in selecting, grading and placing filter media remains one of the most important factors affecting the performance of trickling filters. Many of the ponding difficulties which have plagued operators are traceable either to a media too small or to a media not carefully selected as to grading and soundness. Many filters have been constructed with media specifications calling for 1½-in. to 2½-in. media, but with too little attention paid to the percentage smaller than 1½ in., or even smaller than 1 in. It is recommended that not more than 5 per cent of the media be permitted to be smaller than the lower specified size due to its tendency to fill the voids of the larger media, and also to segregate during placing and to form potential ponding pockets.

Filter media should be rehandled before placing it in the filter in order to avoid placing excessive quantities of fines. Media should be rehandled with forks and placed with wheelbarrows or belt conveyors.

The use of a larger media has been found effective in many plants. A larger media permits better natural ventilation and also permits higher loadings with greatly reduced ponding tendencies. The use of 3-in. to 4-in. media for both standard and high rate filters is advocated. Availability and cost being dominant factors in the selection of filter media in many localities, smaller media will unfortunately continue in use. Larger media is particularly important if filter loadings are to be increased. Higher loadings also result in need for increased underdrain capacity.

Recirculation

There has been quite an accumulation of evidence of the benefits of continuous dosage of standard trickling filters (Drier, *Sew. Wks. J.*, July '46). Recirculation practices at Plainfield, N. J.; Corpus Christi, Texas; San Bernardino, Calif.; Fort Dodge, Iowa, and Litchfield, Ill., are discussed. Dixon (*S. W. J.*, Vol. 15, No. 6, page 1080) also refers to successful use of this practice at a number of plants. There are others unreported.

Recirculation of final effluent to filter influent or of final tank underflow or effluent to the raw sewage can be utilized to maintain continuous flow to the filter in sufficient quantity to keep the distributor turning and the media wet, or to provide parallel recirculation.

Recirculation also tends to eliminate the effect of "soft spots," particularly with shallow filters. Recirculation applied to standard rate filters to maintain continuous dosage has resulted in their ability to handle considerably higher loadings without ponding, has increased efficiency of

existing plants, has assisted greatly in the control of odors and *Psychoda* flies, and has assisted winter operation.

At Corpus Christi, Allison found that recirculating 1,000 gpm. of underflow from the final tanks to maintain constant dosage of the reaction distributors increased overall B.O.D. reduction from 80 to above 90 per cent. Recirculation was about 15 per cent of average flow.

Downes (Plainfield, N. J.) found that by recirculating filter effluent to maintain a constant rate of 7 mgd. to the fixed-nozzle filter (average flow is 4.25 mgd.), 92 per cent B.O.D. reduction was obtained by filters and final tanks at a loading of 1,080 lb. B.O.D./acre-ft. No ponding occurs, and the filter unloads continuously. Practice in England is also recognizing the value of continuous dosage in increasing loading ability. (Thompson and Watson, the *Surveyor*, 103, 225, (1944) and 103, 265, (1944).)

Recirculation was practiced at a number of Army standard filter plants with success. Recirculation was practiced at Fitzsimmons General Hospital at a ratio of 0.75:1, which was not sufficient to maintain continuous dosage. The B.O.D. of the effluent remained about the same, but nitrification increased, indicating increased capacity of the filters.

In new designs we strongly recommend that provision be made for recirculation either of final tank underflow or overflow ahead of the primary tanks, or of final effluent to the filter influent. A good design is to provide for maintaining the maximum hourly flow rate to the filters, which is approximately 1:1 recirculation at average flow. Automatic control of recirculation to maintain this dosage rate is simple in application. This recommendation applies equally to standard filters or to high capacity filters, although for certain high capacity filter applications where waste concentrations are high an increased recirculation ratio is indicated.

Standard vs. High Capacity Filters

In recent years much has been written about high capacity filters. In the literature on both conventional and high capacity filters, two rather definite lines of demarcation have been drawn, one at 600 lb. B.O.D./acre-ft. and another at 3,000 lb. B.O.D. per acre-ft. Filters operating below the lower limit are termed standard or conventional filters, and those at or above the upper limit are termed high capacity filters if the dosage rate exceeds 10 mgad. There has been conjecture that between these loadings is a sort of "no-man's land" where operation difficulty can be anticipated. There is considerable experience to the contrary and it is our thought that there is no danger in applying loadings between those values if the factors previously discussed are given consideration in the design, and particularly if some recirculation is provided. The U. S. Engineers had plants operating at points all along the loading curves and they did not report the need for avoiding any intermediate loading range.

The choice between standard or high capacity filters is usually one of the degree of treatment required; that is, whether the outlet stream requirements warrant discharge of a well nitrified effluent or whether an effluent equally low in B.O.D. but not having the added stability provided by nitrate nitrogen is sufficient to maintain the stream's natural uses unimpaired.

With dry runs, it is obvious that the more complete treatment is necessary to avoid nuisance, but where streams carry reasonable dilution flows and have favorable reaeration characteristics, there seems little reason to require complete nitrification when a low B.O.D. effluent containing no nitrates would not impair the natural functions of the receiving water.

B.O.D. removal by standard or high capacity filters can be thought of with reference to the 20-day B.O.D. curve. The B.O.D. removal curve flattens out as the nitrification range is approached, and the relative cost of removing B.O.D. increases out of proportion to the amount removed. When the nitrification range is reached, however, the oxygen resources of an effluent are increased steeply by the presence of nitrates in the effluent, even though B.O.D. removal may remain about the same. The use of high capacity filters is not advocated where it is obvious that outlet stream conditions require a nitrified effluent. The fundamental differences of the two types of filters should be understood and it should be recognized that similar B.O.D. removal does not tell the whole story and must not be used as the sole application criteria. The real function of economical design should be to seek for effluent quality to meet outlet requirements, and this requirement of good design is now assuming major importance due to the high prevailing construction costs.

The real difference between standard filters and high capacity filters is quantitative, as was shown by Heukelekian in his studies of chemical and biological characteristics of film on biofilters and standard filters. (*S. W. J.*, 17, 2, P. 269). Heukelekian also showed (*S. W. J.*, 17, 3, P. 516) that nitrification is not produced in high capacity filters due to limited contact time and not due to inability to establish a nitrifying flora. Those studies indicated that the high B.O.D. values of the film in the upper portions of a biofilter were not inimical to establishment of a nitrifying flora. Heukelekian also found that the "nitrifying capacity" of the film on standard and high capacity filters is approximately the same with the first stage of nitrification, nitrite production, more firmly established in the biofilter than the second stage, nitrate production. The reverse was true in the standard filter with the absolute quantities of nitrites lower than in the biofilter. The studies indicated that the nitrifying organisms exist in the high capacity filter by means of a limited oxidation, and that they are ready to produce substantial quantities of nitrites and nitrates if the loading is lowered and temperatures favorable.

Supporting data for this contention can be found in reports of other observers. The difference in nitrification between standard and high capacity filters thus becomes one of degree. It was interesting that the maximum nitrifying capacity of the standard filter, which was underloaded, occurred at the two foot level. At heavier loading, the zone of maximum nitrification is undoubtedly in the lower levels of the media.

Distribution

This discussion would be left incomplete if some reference were not made to distribution of flow on high capacity filters. We do not believe that so-called raindrop application of sewage is necessary to obtain adequate flow distribution and obtain satisfactory results from high capacity filters. This conclusion was borne out by unpublished research conducted by Walker and J. R. Sperry. An experimental filter 3 ft. in diameter by 3 ft. media depth was constructed with trays to intercept the flow placed in the filter media at 6 in. vertical intervals on different radii, and provision was made for measuring the instantaneous flow rate from each tray. A rotary distributor was constructed and provision was made for varying the dosage interval. The filter media was obtained from the Aurora San. Dist. filters and the media contained a nor-

mal film growth which was built up by several weeks of operation prior to the test run. Settled sewage was used in the tests. Dosage intervals of from 3 to 120 seconds were used.

It was found that at dosage intervals of 15 seconds there was a constant flow rate from each tray located more than two media diameters below the surface, as there was at dosage intervals less than 15 seconds. When the dosage intervals increased materially above 15 seconds, however, the flow rates from the trays became increasingly intermittent, and at 120 second intervals actually surged following passage of the distributor over the area tributary to a tray.

Based on the results of these experiments and on the study of filter performance in the field, we recommend approximately 15 to 20 second dosing intervals for all filters, with provision for continuous operation of the distributor. It is of interest that with all of the plants operated by the U. S. Engineers, there has been no report indicating any particular advantage from continuous application in the form of droplets of the nature of a shower.

An experiment of interest was conducted while starting an Ohio plant in operation. An 18 inch diameter disc was placed on the surface and left in place until a good growth had developed on the media. The disc was then removed, and digging into the filter indicated that the media below the disc had not developed a film, which clearly indicated that the flow is vertical. The importance of eliminating any totally ponded areas, however small, is thus made rather obvious.

Roughing Filters

High capacity filters loaded at extremely high values are termed roughing filters. Loadings on these filters may vary from 5,000 to 20,000 lbs. B.O.D./acre ft., and recirculation is usually practiced. Efficiencies of these filters may vary from 20 to 50 per cent in B.O.D. removal, but the efficiency doesn't tell the whole story and is actually misleading in most applications. For example, a roughing filter operating at 15,000 pounds of B.O.D./acre ft. at an efficiency of 30 per cent will remove 2.5 pounds of B.O.D./cu. yd., while a filter loaded at 3000 pounds/acre ft. at an efficiency of 65 per cent will remove only 1.15 pounds/cu. yd. The removal per unit of volume of roughing filter is thus quite high, although overall removals are low. This makes the roughing filter serve a useful purpose as an economical method of treatment when the problem is to remove pounds of B.O.D., either as a method of first stage treatment or as an adjunct to "bail out" an overloaded existing plant.

Conclusions

It is contended that present standard filter design loadings are unnecessarily conservative in the light of advancing knowledge of factors affecting their performance. We believe that standard filter loadings of 500-800 lb. B.O.D./acre ft. (87 to 55 cu. ft./lb.) are entirely reasonable if a fresh sewage is applied to filters *not less than* 4 *ft. deep*, and if sufficient attention is given to preliminary treatment, distribution, recirculation, media size and ventilation through an adequate underdrain system.

It is believed that this is an appropriate time for regulatory agencies to consider revised design standards. Filters are just coming into their rightful place in the waste treatment field due to increased knowledge of factors affecting their performance resulting in more economical design.

It is important to the public interest that this increased knowledge be recognized and reflected in design standards in view of the tremendous construction of sewage and industrial waste treatment works which is pending.

Utilization of Sewage Sludge as Fertilizer

Federation's Manual of Practice No. 2

The Federation of Sewage Works Associations has issued its Manual of Practice No. 2. Titled the "Utilization of Sewage Sludge as Fertilizer," this 120 page treatise has been awaited since it was authorized in October 1945 by the Board of Control of the Federation.

More than a mere report on the use of sewage sludge as a soil conditioner, this bulletin contains 45 tables and a bibliography of 251 references and is a practical approach to a large number of aspects of the subject. Divided into seven sections, besides the introduction, summary, and bibliography, the manual carefully examines the fertilizer requirements of soil; fertilizer characteristics of sewage sludge; effect of sewage treatment practices on fertilizing elements in sludge; processing sludge for use as fertilizer; applications of sludge as fertilizer; hygienic aspects of sludge utilization as fertilizer; and prices, marketing, and economic considerations.

The extent to which each of these chapters or phases is considered is obvious from a perusal of the table of contents. For example, on the subject of "Fertilizer Characteristics of Sewage Sludge," complete analyses of sludge are given, as are opinions of agricultural experts, effects of sludge constituents on soil, and fertilizer characteristics of heat dried activated sludge; fertilizing values of other types of sludge are dealt with.

The book has been made available to every member of the Federation of Sewage Works Associations. Fifteen per cent discount is allowed on orders of 300 copies or more. This is a book that every sewage treatment works operator, every consulting engineer, and every engineer in state health departments should have on his desk. It will also be of interest to agronomists, horticulturists and floriculturists. It should go far toward enlightening the public as to the real values of sewage sludge, dispell fears, and eliminate false impressions about sludge.

The original draft of the manual No. 2 was compiled by a sub-committee consisting of A. H. Niles, Supt. of Sewage Treatment, Toledo, Ohio, as Chairman; Dr. Willem Rudolfs, Chief of the Dept. of Water and Sewage Investigation of the New Jersey Agricultural Experimental Station; L. W. Van Kleeck, Principal Sanitary Engineer, Connecticut Dept. of Health; F. W. Gilcreas, Director of Laboratories, N. Y. State Dept. of Health; and T. C. Schaetzle, Supt. of Sewage Treatment, Akron, O.

The final manual was collated and prepared for publication by Langdon Pearse, Sanitary Engineer of the Sanitary District of Chicago; Dr. F. W. Mohlman, Director of Laboratories, Sanitary District of Chicago, and W. H. Wisely, Exec. Secy. and Editor of the Federation. Publication was prepared under the direction of the Federation's Committee on Sewage Works Practice of which Morris M. Cohen of Schenectady is Chairman.

Copies of Manual No. 2 are available at 75 cents to members and $1.25 to non-members. Fifteen per cent discount is allowed on orders of 300 copies or more. Copies may be obtained from the Federation of Sewage Works Assns., 325 Illinois Building, Champaign, Ill.

SPECIAL CHARGES FOR INDUSTRIAL WASTES IN MUNICIPAL SEWAGE

Modern Trend Is Toward Formulas for Equitable Service Rates for Industries Discharging Excessive Waste Loads to Municipal Sewage Works

IN THE June, 1946, number of *Industrial and Engineering Chemistry*, Harold R. Murdock's regular feature on "Waste Utilization" discusses the topic of special charges for industrial wastes accepted into the city sewers for treatment with the domestic sewage at the local sewage treatment plant. A month later in the July number of the *Southwest Water Works Journal*, Dr. S. R. Wright, Head of the Civil Engineering Dept. of Texas A. & M., wrote on the same subject. These two articles bring into sharp focus a trend that seems likely to be an important factor in the solution of many industrial waste problems in the future.

Mr. Murdock states that "The rental of municipal sewage systems can become a convenient means for industry to dispose of its liquid wastes," but points out that "equity to all concerned in disposition of waste products is essential." Mr. Murdock then mentions good and bad practices in the matter of approach to the problem, emphasizing the need for cooperation with rather than persecution of industry.

Mr. Murdock's discussion cited the early statements of Marsten and of Waring regarding the matter of sewer rentals and the need for providing for wastes of excessive strength. Several early agreements were noted wherein industry has paid part of the cost of operation as well as part of the construction costs of sewage treatment plants handling these wastes. A notable example is that of Cedar Rapids, Iowa. Most of these agreements have been based on yearly or negotiated charges, but as Mr. Murdock points out, within the past three years charges based on concentration of waste have been instituted at two municipalities.

Regarding these two municipalities and this innovation, Mr. Murdock has this to say:

"Buffalo, N. Y., is reported to be the first city to apply such regulations. The service was started in February, 1943. As reported by Symons and Crane in the March, 1944, issue of *Water Works and Sewerage*, the following formula is used for calculating the charge applied:

$$R = FP_c(C - N_c) + FP_s(S - N_s)$$

where R = rate of special charge, cents/1000 cu. ft. of waste volume.

F = factor for converting ppm. to lb./1000 cu. ft.

P_c = contract price of chlorine, cents/lb.

C = concentration of chlorine demand of waste, ppm.

N_c = normal dry weather chlorine demand of raw sewage, ppm. of sewage received at treatment works.

P_s = cost in cents of chemicals for sludge conditioning, and of power for solids disposal resulting from 1 lb. of suspended solids received in raw sewage at treatment works.

S = concentration of suspended solids in waste, ppm.

N_s = normal grit-free suspended solids of raw sewage as received at treatment works, ppm.

The factor P_c may vary from year to year according to the contract price for chlorine, and the factor P_s may vary according to the price of chemicals and power involved in the disposal of solids, as determined from operations for the previous year or previous two years. The factors C and S may be established by analysis (periodic or otherwise) to obtain average concentrations to be applied for any agreed length of time.

"Average sewage results at Buffalo are 5.6 ppm. chlorine demand and 157 ppm. suspended solids. The special charge for 1000 cubic feet of waste amounts to 0.136 cent for each ppm. chlorine demand and 0.00305 cent for each ppm. suspended solids determined by the sewage analysis. It has not appeared economically feasible to apply a special charge when the rate is less than 1 cent per 1000 cubic feet of waste volume. The application of these charges has been successful so far in Buffalo. When questions arise, cooperative and friendly negotiations have solved the problem.

"In February, 1944, New Brunswick, N. J., passed an ordinance based on the premise that all wastes should be treated at the municipal plant without pretreatment by industry. The ordinance stated: 'The charges for factory effluents or industrial wastes discharged into the city sewers or tributaries thereof shall be fixed and determined according to flow, suspended solids, and chlorine demand, according to the following schedule of rates: $22.00 per million gallons, $5.00 per ton of sludge, and $5.00 per 100-pound chlorine demand.' Chester Paulus, mayor of New Brunswick, reported in July, 1944, that 'if industrialists are willing and do cooperate, most industrial wastes can be handled in adequately designed sewage treatment plants constructed for the treatment of domestic sewage; but in this cooperation the industrialists must be prepared to pay their full share of the cost of the plant enlargement and plant operation.' "

Mr. Murdock concluded that "there appears to be ample justification for combining the disposal of industrial residues with municipal sewage in a common processing plant. The total cost should be lower in such unified operation. When industries have to pay service charges, they will be more inclined to use every means available to reduce the over-all load on processing plants."

Dr. Wright, whose article originally appeared in the *Texas Engineer* wrote as follows:

"There are two methods of handling charges for industrial wastes. One method places the responsibility of pretreatment of sewage on the industry so that the industrial wastes entering the city's system will come within prescribed standards of strength, and the industry then would pay for sewerage service on a volume basis at the regular rate charged to other customers. Under the other method the city receives the raw sewage from the industry and adjusts the rate to compensate for strength of the sewage.

The method requiring industries to pretreat their wastes has many advantages. The city is able to place all customers on an equal footing as far as charges are concerned. Strong industrial wastes are by-products of industries and the cost of treating these wastes to bring them to the strength of normal sewage should be a part of the cost of production of the industry's finished product. Shock loads from strong industrial wastes may upset the bacterial action in the sewage treatment plant. While such a requirement of pretreatment by industry of its wastes would be very desireable from the standpoint of the city, it is not always practical. The wastes from certain industries might be slightly stronger than the prescribed standard of normal sewage but would not be sufficient to justify a treatment

plant. In other industries it may be undesirable or impossible to place the pretreatment facilities at the plant site. The owners of large plants often are influential in local politics and may make it difficult for the local city administration to enforce such regulation.

"If pretreatment of industrial wastes is not required of industries, some adjustment should be made in the rate schedule to compensate for the concentration of the sewage.

". . . Wastes from establishments that contribute wastes of approximately the same concentration as sanitary sewage are not usually classed as industrial wastes. . . . It is well to provide that an industry must make application for sewerage service and in many cases the regular sewage rate can be applied; but for those industries with wastes of an abnormal character, a special study of volume and concentration can be made and an agreement can be reached with the industry relative to the charges before service is granted."

Where primary treatment only is afforded, Dr. Wright recommends that the basis of special charge be suspended solids, and if chlorination is used, suspended solids and chlorine demand should be the basis of charge, while if complete treatment is afforded, then the basis of charge should be suspended solids and B.O.D.

Dr. Wright assumes that 50 per cent of the suspended solids will be removed in primary treatment alone. "In the case of industrial waste, since the added cost of operation, due to the concentration is the added cost of treatment, it will be necessary to estimate the ratio of the annual cost of operating the treatment plant to the total amount cost of operating the entire sewage works system. If the charges are intended to pay all costs, the fixed charges should be included in both annual costs, but if the charges are to defray only the operating expenses, then the annual costs used to determine this ratio will be only the operating expenses of the treatment plant and the total operating expense of the system. The added cost of treating a thousand gallons of industrial waste will be due to the excess solids contained by the waste above that of normal sewage which ordinarily will be about 150 parts per million. But where primary treatment is the only treatment involved, about half of the total suspended solids will pass off with the effluent and will not add to the cost of treatment. When charges are to be determined for a given industry several tests for suspended solids should be made on the industrial waste in question. With the above information, a factor to multiply the regular volume rate by, to adjust for concentration, can be determined. Expressed as a formula this factor would be:

Formula:

$$F = 1 + \frac{.5R\ (S - 150)}{150} \text{ or}$$

$$F = 1 + \frac{R\ (S - 150)}{300}$$

"Where F is a factor by which the regular volume rate is multiplied, R is the ratio of the annual cost of treatment to the total annual cost of the entire system, and S is the suspended solids, expressed in parts per million by weight, in the industrial waste in question. An example will illustrate. Assume that the cost of the primary treatment is $20,000 per year, and that the annual cost of operating the entire system is $50,000. Then R in the above formula becomes 0.4. One industry contributes a waste containing a suspended solid content of 750 ppm. Substituting in the above formula, F becomes 1.8. In fixing the charge for this industry the regular rate per thousand gallons should then be multiplied by 1.8, or in other words, this industry should pay 1.8 times as much per unit volume as a user of the system who contributes only domestic sewage."

This formula works equally well and equitably for industries whose suspended solids input is far below the average. Dr. Wright suggests that where the factor F is between 0.9 and 1.1 (i.e. suspended solids of 75 to 225 ppm.) it should not be necessary to make any adjustment in the regular sewage rate.

When complete treatment is afforded, Dr. Wright assumes the average B.O.D. of domestic sewage to be 200 ppm. and adds another term to the formula to take into account the secondary treatment in the following manner: "The added cost due to a heavy organic content would be $\frac{\text{B.O.D.} - 200}{200}$ times the normal organic load. But since approximately one-third of the B.O.D. is usually removed in the primary treatment the added cost due to the extra load on the secondary treatment is due to only two-thirds of the total organic load in the industrial waste. Therefore, the factor by which the volume rate must be multiplied where complete treatment is involved may be expressed as:

$$F = 1 + \frac{R\ (S - 150)}{300} + \frac{2R\ (\text{B.O.D.} - 200)}{3 \times 200}$$

Which can be simplified to:

$$F = \frac{300 + R[(S - 150) + (\text{B.O.D.} - 200)]}{300}$$

where F is the factor by which the volume rate is multiplied, R is the ratio of cost of treatment to the total cost of operation of the sewerage system, S is the suspended solids in the industrial wastes expressed as ppm. and B.O.D. represents the 5-day B.O.D. in ppm. of the industrial waste. As an example, let R be assumed to be 0.6. A local packing house discharges a strong solid content of 1,000 ppm. and a 5-day B.O.D. of 3,000 ppm. Under these circumstances F would be 8.3 times the unit rate for ordinary domestic sewage. On the other hand, an industry similar to the one quoted in the preceding example which discharges relatively clear water into the sewers could receive an adjustment in its rate schedule."

In this case too, Dr. Wright recommends no adjustment of the normal rate when the factor F is between 0.9 and 1.1; under which condition the B.O.D. could vary 100 ppm. or more without affecting the actual rate charged.

Dr. Wright concluded with the thought that it is desirable to base industrial sewage rates on volume of water actually discharged to the sewers, and to make the adjustment on the concentration basis even though some other basis of charge is used for the domestic sewage.

The formulas suggested by Dr. Wright are a variation of the principle adopted in the Buffalo Formula, namely that industry should pay an extra service charge for any load it imposes on the treatment plant over and above the load normally to be expected in the same volume of domestic waste.

Within recent months Dr. Abel Wolman, Prof. San. Engr., Johns Hopkins University, at the AWWA convention in St. Louis, Dr. George E. Symons, Assoc. Ed., *Water & Sewage Works*, and Morris Cohn, Ed. for *Sewage Works Engineering*, both at the Purdue Industrial Waste Conference, have all enunciated the principle that industry must bear its fair share of the cost of sewage treatment when its wastes are discharged to the city sewers and that such costs must be considered a legitimate cost of production.

The above formulas and ideas are presented here in hopes that they may serve as a basis for discussion among industry and municipalities faced with this problem. Its solution is not impossible and can be made quite equitable. (G.E.S.)

NINTH EDITION–STANDARD METHODS

(A BOOK REVIEW)

AFTER two years of production work, the 9th Edition of *Standard Methods for the Examination of Water and Sewage* is now available. This standard work, issued jointly by the Amer. Public Health Assn. and the Amer. Water Works Assn., has been in preparation under the direction of a Joint Editorial Committee for the past several years and revisions in methods of analysis have been kept up to date insofar as possible, as the work progressed. The revision of the methods on sewage analysis was done by a special committee of the Federation of Sewage Works Assns.

Changes in Organization And Format

The principal changes to be noted in the 9th Edition fall into two categories: Organization and Format and Revision of Methods. Most noticeable change in format is the use of two columns of type and the division of the book into four parts and two appendixes instead of seven parts and one appendix.

In Part I devoted to Water Analysis, the methods of analysis "are arranged independently of the type of water being analyzed." Persons "interested in special types of water such as boiler feed water, boiler water, or railroad water supplies will easily find suitable methods under the appropriate constituent required."

Part II includes Sewage, Sewage Effluents, Sludges and Muds, and Industrial Wastes; Part III covers Microscopical Examination of Water, Sewage, Sludge and Bottom Sediments; while Part IV is devoted to Bacteriological Examination.

Appendix I, as in the 8th Edition, contains the Non-Standard Methods, i.e., those methods which have not yet reached a state of reasonably general acceptance in the laboratory field, but methods which it is hoped will receive further study and development. Many of the non-standard methods of the 8th Ed. have been "moved up" into the standard sections. Others have been deleted.

Appendix II consists of two sections, the first containing the ACS Reagent Grade Chemicals, (brought up to date), while the second is a new departure and contains the directions for making the ordinary laboratory reagents and indicators, as for example, 0.1 N HCl, methyl orange, etc. This system makes unnecessary the repetition of such directions in several sections of the text. It also gives directions for preparation of all of the reagents used, an improvement over the previous edition. Directions for making special reagents are given under the particular method.

Other changes include listing of the page as well as the part and section wherever a method of analysis makes a reference to some other section of the book and standardization of divisions and subdivisions of the several sections. This standardization was carried into the parts on Microscopic and Bacteriological Examinations, insofar as possible. The Index, too, has been completely revised.

Revision of Methods

Almost all of the methods of analysis or examination given in the 8th Ed. have been rewritten, or completely revised. Several new methods have been added; a few have been deleted. Some of the more important changes are detailed below.

In Part I on the Physical and Chemical Examination of Water, the oxygen consumed test (from permanganate) has been dropped. New analyses added to this edition include arsenic, chromium (hexavalent and total), ortho-, meta-, and pyrophosphate, tannin and lignin, and methane gas. In addition a number of methods have been completely revised.

Outstanding revisions include: Complete revision of the threshold odor test; addition of the palmitate method for hardness and the electrometric method for pH; new technics for carbon dioxide, bicarbonate, carbonate and hydroxyl ions according to the work of Moore; revised residual chlorine and chlorine demand tests (AWWA Committee) and fluoride method.

Part II on Sewage Analysis has been completely revised and rewritten, particularly the sections on sample collection, expression of results, and physical examination. Other significant changes include: dropping of albuminoid nitrogen, adoption of boric acid for the distillation method for nitrogen; revised procedure for oxygen consumed; complete revision of all modifications of the dissolved oxygen test and addition of method for D.O. in activated sludge mixed liquor; a new technic for settleable solids; changes in residual chlorine and chlorine demand tests to conform to the procedures used in water analysis (spot plate test for field use added); titration and colorimetric methods for hydrogen sulfide; new technic for grease; and two indexes for activated sludge (Sludge Volume Index and Sludge Density Index).

Part III on Microscopical Examination of Water, Sewage Sludge, and Bottom Sediments has been revised and rewritten with new equipment and new forms for reporting results.

Part IV on Bacteriological Examination contains the addition of Tryptone Glucose Agar as a plating medium, and Lauryl Sulfate Tryptose broth for coliform bacteria. Fuchsin broth and Formate Ricinoleate broth have been deleted as confirmatory media. The schematic outlines have been revised, as has the section on coliform density. Bacteriological examination of water from swimming pools is included as a standard method; the Gram stain test is now a part of the method for coliform; and the Eijkman test has been added to the section of differentiation.

In Appendix I on Non-Standard Methods new tests introduced include chromium, selenium, volatile acids in digested sludge, oxygen demand and activity of activated sludge, grease in sewage (by wet extraction and extraction of coagulated sludge), and colorimetric pH of sewage and sludge.

Delays in printing made it impossible in the latter stages of production to keep pace with the most recent developments in methods of analysis. To do so would have delayed the issuance of the book many months, a delay the Editorial Board decided against. As a result of this decision, there are a few methods that are somewhat out of date now. This minor criticism is, however, greatly outweighed by the many other improvements and by the availability of a revision of the long outdated 8th Edition.

The book may be obtained for $4.00 from the Am. Pub. Health Assn., 1790 Broadway, New York 19, N. Y. (G.E.S.)

SANITARY SEWERS— HOW BIG SHOULD THEY BE?

Some Evidence Indicating That Money Is Being Wasted in Over-design of Lateral Sewers

By ARCHIE B. UZZLE, JR.
Ass't Sup't
WATER AND SEWER DEP'T
RALEIGH, N. C.

The Author

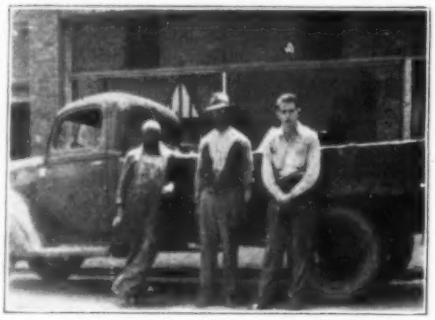
IS YOUR town spending more for its sanitary sewer installation than is really necessary?

If yours is one of the towns that require a minimum size of 8 in. diameter for all sewers, and I have run into quite a few officials of sewerage systems who say they never install smaller than an 8 in. sewer, then the experience of Raleigh, N. C., will certainly be of interest and may be the means of some towns saving a considerable sum in these days of high costs.

Raleigh, a city of 65,000 population, has the separate sewer system, its sanitary sewers carrying only domestic sewage and a very small quantity of industrial wastes. The sanitary sewerage system consists of 94.7 miles of 6 in. terra cotta pipe laterals and 15.7 miles of 8 in. terra cotta pipe laterals. Standard size of all new lateral installations is 6 in. diameter. Minimum slope allowed on all sewers is 0.5 per cent. If Raleigh had installed 8 in. pipe for its sewer laterals, as a number of cities do, instead of 6 in. pipe, the difference in first cost for its total of 94.7 miles of 6 in. pipe now installed would be $50,000 based on the difference in first cost between 6 in. and 8 in. T. C. pipe, which is approximately $0.10 per foot. Of course, there are other costs that are higher in laying 8 in. than in laying 6 in. sewers, but we have considered only the pipe costs.

Raleigh's "Miracle Sewer"

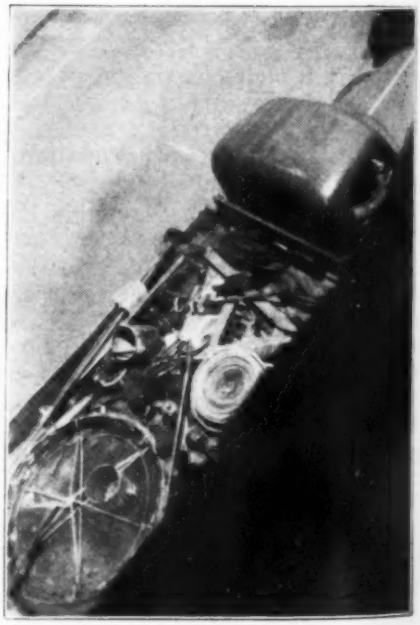
Just what will a 6 in. sanitary sewer do? How many connections will it service? This, of course, depends on the grade or slope of the sewer and the timing of the contributions to its flow. A six inch sanitary sewer here in Raleigh is certainly serving more connections than would be expected of it, for it now has connected to it a total of 206 apartments, 50 single dwellings, four stores, eight warehouses and one sawmill. This present total of contributors to this sewer line so astounded me that I began doing a little checking on it. The slopes of its various parts and the locations of its contributors are shown in the accompanying sketch. Several mornings, during the time of peak flow, which is between 8 and 9 a. m., I walked this sewer line, going into the manholes and measuring the depth of flow.



Sewer Maintenance Truck and Crew, Raleigh, N. C.

On the flattest slope (0.97 per cent) the depth of sewage at peak flow was five inches or 0.89 of full. Using discharge diagrams based on Kutter's Formula, with $n = 0.015$, a six inch sewer flowing 0.89 full with the above slope of 0.97 per cent will carry 0.356 cu. ft. per sec. or 2.66 gals. per sec., which is the worst flow condition to be expected in this six inch line from the large number of contributors. This flat slope section, therefore, could carry about 30 more apartments before running full.

The present peak discharge of 2.66 gals. per sec. is the equivalent of the discharge of 3.5 commodes reaching a given point in the sewer simultaneously, based on commode discharging 7.5 gals. in 10 seconds; 3.5 commodes is 1.36 per cent of the total number of 257 contributing commodes above the point of measure-



Sewer Maintenance Truck and Equipment

ment on the flat slope section. This would indicate that smaller sewers can be installed than are considered necessary under present day methods.

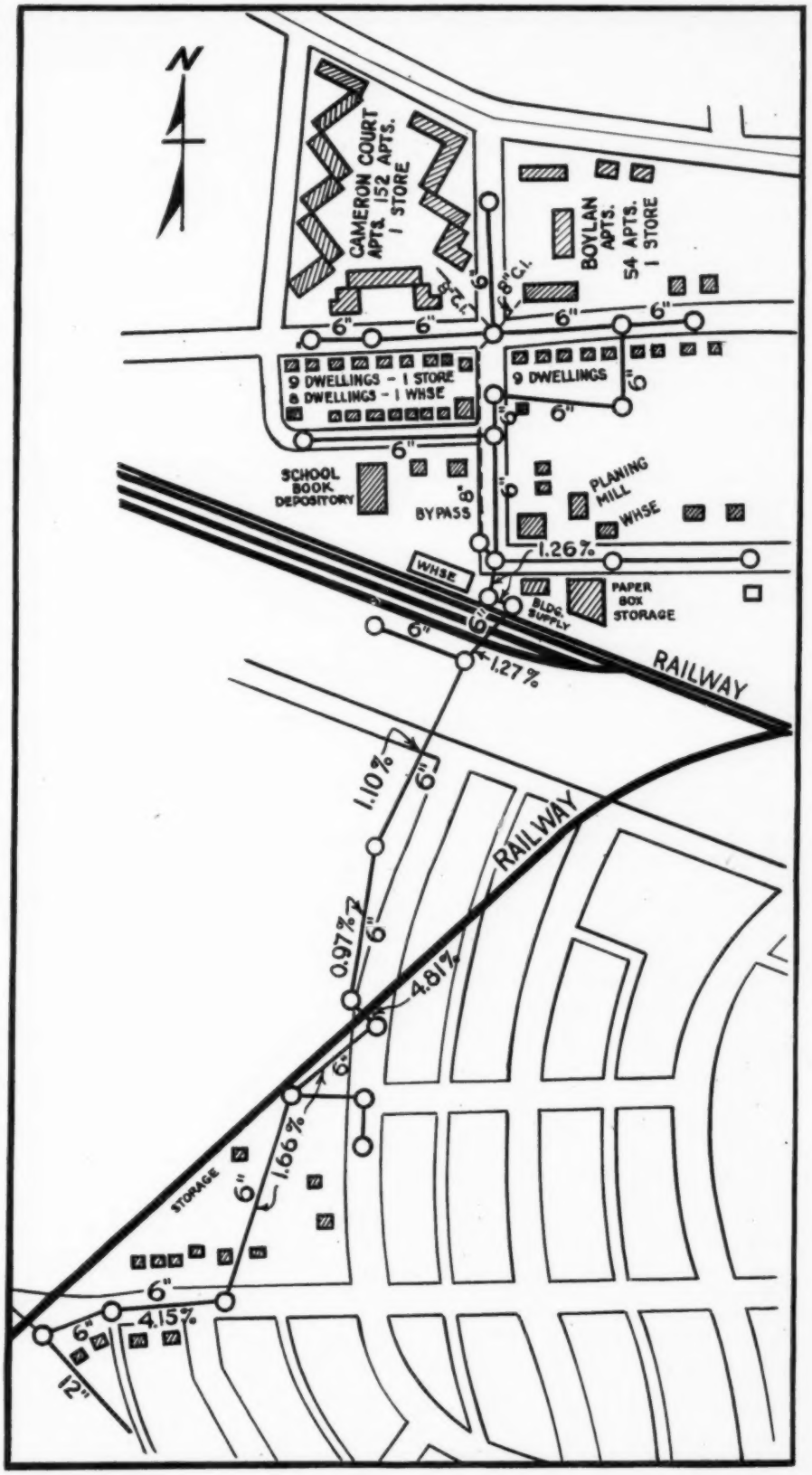
A Precaution That Hasn't Been Justified

Before construction of the 204 apartments just before World War II, hardly a week passed without at least one stoppage occuring in the flatter portions of the 6 in. sewer. In fact, this was the reason for putting in the 8 in. bypass shown just north of the railway tracks in the accompanying sketch. A stoppage in the 6 in. pipe near the apartments would result in flooding the basements of the apartments, so the precautionary protection of the 8 in. bypass was provided. If stoppage from the railroad tracks south should occur, it would cause overflow on the ground only, so it was decided not to run the 8 in. bypass further at that time. It has now been found not necessary to extend this 8 in. line because since putting these apartments on the line over four years ago, not a single stoppage has occurred. This in itself constitutes an argument in favor of smaller sewers.

Lower Maintenance Costs

All of Raleigh's sanitary sewerage system and its storm sewer system are maintained in good operating condition by the three men who are shown standing beside their truck. They are: Mr. George Hamilton, foreman, and Ben Stokes and Charley Brown, all old timers with the city. The view of the contents of the truck would appear as a heterogeneous hodge-podge of bomb wreckage, but every article shown has its useful place at the proper time, and these three men certainly know how to use them all. Raleigh is, and should be, proud of its economical maintenance of sewers.

It would be interesting to know what size sewer engineers throughout the country would select to take care of the loading existing on the six inch sewer described herein.



6 in. Sanitary Sewer—Raleigh, N. C., Serving 206 Apartments, 8 Warehouses, 50 Dwellings, 4 Stores

Note: Construction and maintenance of the Sanitary Sewerage System of Raleigh is a function of the Department of Public Works, of which Mr. W. B. Barrow, Jr., is the Commissioner.

ANOTHER MAJOR STRIDE FOR A.W.W.A.

Taking off their coats and going to work on Sunday, January 12th, in Chicago, and keeping at it without letup through Monday and part of Tuesday, the 14th, members of A.W.W.A.'s Board of Directors accomplished much in a staccato tempo under the baton of Secretary Jordan and the capable presiding of President LaDue. Thought to be overall the best attended and most productive meeting ever held by an A.W.W.A. board, the new 1947 board seemed to proceed as a well-lubricated machine from the opening gavel.

Before completing its many jobs this board examined, discussed, and approved the largest budget in the history of the association. Realizing the importance of its public relations program, started during the past year and estimated to cost $12,000 for the year 1947, the board approved a recommendation of Secretary Jordan to tap the reserves or surplus of the association to the extent of $10,000, or any lesser amount, which may be required to maintain the schedule set for the production of "Guides to Public Relations." These are being supplied members of A.W.W.A. in loose leaf installments, designed to comprise a "Manual on Public Relations for the Water Works Man" when the series is complete. Thereafter, the Manual will be kept up to date and alive with case histories of how and by what procedures public relations have been improved in named representative instances. Indicative of the importance attached to a well developed and sound program of public relations for the water works industry, it is the first time in the history of A.W.W.A. that a board has deliberately voted an expenditure of such proportions from surplus funds.

Looking also to the advancement of the status of the water supply industry in the public eye, as a whole, and the improved personal status of management and workers in the industry, what appears to this writer as the most important step yet taken by the association in this direction is the decision of the 1947 board to establish a new constitutional committee in A.W.W.A. which is to rank with the association's two existing constitutional committees—the Committee on Water Works Practice and the Publication Committee. This new committee which, like the important Committee on Water Works Practice, is to consist of a number of subcommittees headed by men having the highest qualifications for such posts. The name of the new committee is the "Committee on Water Works Administration." In distinction to the Committee on Water Works Practice, which has done such a laudable job in the direction of improving materials, equipment and technical practices in the industry, the new committee will deal with all phases of personnel and human relations in water works management and operation—especially in every phase of administration, policy and operation in which contact is made with the customer, the general public, or local political bodies. It will also devote its attention to such matters as short schools, operator licensing and standardization of operator licensing requirements and procedure, to pension and retirement plans, to rate-making procedures, to water works organization, to annual report making, to compensation schedules, to billing and collection practices, to water works publicity and methods of financing, developing and floating bond issues, to accounting practices, to main extension policy and practices, and the like. In short, this new Committee on Water Works Administration, conceived and advocated by President LaDue, and established on motion of Linn H. Enslow, newly nominated Vice-President of A.W.W.A. and chairman of Committee on Program and Publications, is to be charged with any and all activities of A.W.W.A. which presently exist, or shall be instituted in the future; this with an aim to the advancement of the status of the water supply industry in the public eye and to better the position in the community and to improve the personal status of all who are associated with this industry, so essential but so inadequately appreciated or recognized either in terms of its relative importance to the community or in terms of compensation to employees commensurate with their training, ability, or service rendered. With such aims and objectives set up for it we hope to see this new committee carefully chosen and wish it Godspeed.

HONORS AND AWARDS

Customarily it has been our practice to devote two pages in the February number of this magazine for reporting "A.W.W.A. Board Actions", taken at its annual January meetings. Due to the strike in the plant of our printers, just recently settled, our February issue looks a long way off at this writing since our January number is not yet on press. We are therefore scrapping the editorial originally prepared and are devoting this page to a sketchy account of A.W.W.A. board actions rather than risk uncertain delay by waiting until February to publish the news.

The board approved the following as official nominees for offices in the year 1947-1948:

As President—N. T. Veatch, Jr.
As Vice-President—L. H. Enslow.
As Treasurer—W. W. Brush.

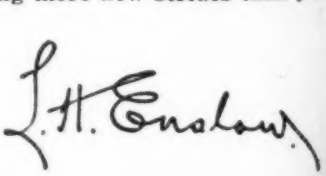
To the following were voted honorary memberships:
Malcolm Pirnie, of Scarsdale, N. Y.
John H. Cook, of Patterson, N. J.

The John M. Diven Medal Award, made to that member contributing most to the good of the association during the year, was voted to E. L. Filby, of Kansas City, Mo., for his direction of the activities of the Association's Survey Committee on Public Relations and his most timely report as head of this inter-sectional committee, which proved of marked importance as a guide to the executive committee of the board in developing the current program of public relations studies by the association.

The John M. Goodell Prize, awarded the author of the most valuable paper of the year published in the *A. W. W. A. Journal,* was won by Louis R. Howson, of Chicago, who was cited for his two papers—"Guides and Checks on Water Works Operation", published in the January, 1946, issue of the Journal, and that on "Construction Costs and Water Rates", published in the June, 1946, issue, and likewise featured in the June, 1946, issue of this magazine.

In reporting on the "State of A.W.W.A.", Secretary Jordan cited 1946 as the all time record year for gain in new members—namely 816, and an all time record year for the volume of Journal advertising. Incidentally, the net membership gain for the year established a new record of 6,141 total memberships, as compared to only 2,724 just ten years ago at the close of 1936.

Yes, A.W.W.A. is making more new strides than just one or two.



MEETINGS SCHEDULED

Feb. 11-12—PORTLAND, ME.
Maine Water Utilities Association. Sec'y, Earle A. Tarr, Supt., Water District, Winthrop, Me.

Feb. 19—NEW BRUNSWICK, N. J. (Hotel Roger Smith)
New Jersey Section A.W.W.A. (Luncheon and Afternoon Program.) Sec'y, C. B. Tygert, Box 178, Newark, N. J.

Feb. 23-25—ST. LOUIS, MO. (Statler Hotel)
American Concrete Pipe Association. (National Convention.) Director, Howard F. Peckworth, 228 N. LaSalle St., Chicago, Ill.

Mar. 13-15—ST. PAUL, MINN. (Lowry Hotel)
Minnesota Section A.W.W.A. Sec'y-Treas., R. M. Finch, 416 Flour Exchange Bldg., Minneapolis, Minn.

Mar. 19-21—TRENTON, N. J. (Stacy-Trent Hotel)
New Jersey Section A.W.W.A. Sec'y-Treas., M. S Kachorsky, P. O. Box 283, Manville, N. J.

Apr. 7-10—CHICAGO, ILL. (Palmer House)
The National Ass'n of Corrosion Engineers. Exec.-Sec'y. A. B. Campbell, 711 Main St., Houston, Texas.

Apr. 10-11—BUFFALO, N. Y. (Statler Hotel)
New York Section A.W.W.A. (Spring Meeting.) Sec'y-Treas., R. K. Blanchard, 50 West 50th St., New York.

Apr. 17-18—CHICAGO, ILL. (Congress Hotel)
Illinois Section A.W.W.A. Sec'y-Treas., H. A. Tolburg. 2020 S. Fifth St., Springfield, Ill.

Apr. 25-26—HAVRE, MONTANA
Montana Section A.W.W.A. Sec'y, C. W. Brinck, State Board of Health, Helena, Mont.

May 7-9—INDIANAPOLIS, IND. (Antlers Hotel)
Indiana Section A.W.W.A. Sec'y Charles H. Bechert, 200 Underwriters Bldg., Indianapolis 4, Ind.

May 21-22—LAFAYETTE, IND. (Memorial Union Bldg., Purdue Univ.)
Third Industrial Waste Utilization Conference. Gen. Chairman, Prof. Don E. Bloodgood, Purdue University, Lafayette, Ind.

May 26-27—ALBANY, N. Y. (Hotel Ten Eycke)
Joint Meeting **New England Sewage Works Assn.** and **New York State Sewage Works Assn.** Sec'y, N.E.S.W.A., Walter Merrill, State Dept. of Health, Boston, Mass.; Sec'y, N.Y.S.S.W.A., A. F. Dappert, State Dept. of Health, Albany, N. Y.

June 19—(Place not decided).
N. J. Section A.W.W.A. Outing. Sec'y, C. B. Tygert, Box 178, Newark, N. J.

July 21-25—SAN FRANCISCO, CALIF. (Auditorium)
American Water Works Association 1947 Conference. Executive-Secretary, Harry E. Jordan, 500 Fifth Ave., New York 18, N. Y.

July 22-24—SAN FRANCISCO, CALIF. (Auditorium)
Federation of Sewage Works Associations. (20th Annual Meeting.) Executive-Secretary, W. H. Wisely, 325 Illinois Bldg., Champaign, Ill.

(Meetings and Exhibits in the Auditorium.) Application blanks for hotel accommodations will be mailed to members by the respective Association Headquarters about Feb. 1st, 1947.

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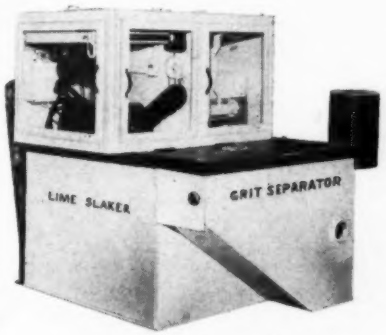

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Write for Bulletin 5-8

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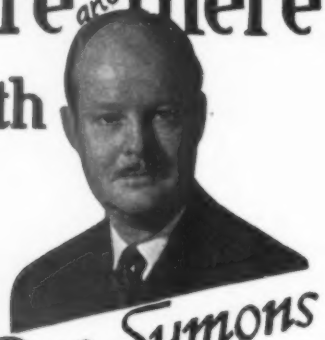
Here and There with Doc Symons



This being the first issue of 1947, it's time to cast an appraising eye backward and a quizzical eye forward, and I'd really planned to do just that but—as I sit here at my typewriter this New Year's Day—all I can think of is—"It's mighty discouraging sometimes." Which is another way of saying, "Our December issue is late again—because of a strike—another strike in our printer's shop."

Well, thanks to strikes at our printers, we were consistent in 1946 —Yep, because of a strike of the typographical union in Chicago in Oct. 1945, we started out 1946 with the January issue late—and we ended the year the same way—with the December issue late—thanks also to a strike of the typographical union in Chicago.

Anyway, the December issue hasn't been printed yet as I write this item for the January issue—so-o-o-o I'll just hold my review of 1946 until next month.

* * *

Should have told you long ago that Cliff Fore, Supt. of the Carbondale, Ill., Water Works, and Chairman of the Ill. Section, A. W. W. A., has become one of the Dual-Personality Boys.—He's now Supt. of Sewage Treatment at Carbondale, as well. Yes, sir, Cliff's title is now Superintendent of Clean and Dirty Water.

* * *

When Dick (Zeolite) Wagner gave a terrific slice to his drive in a golf game at the famous Sea View course near Atlantic City, it was our own Jim Angell who quipped, "What you need, Dick, is some Corexite."—And, by the way, have you seen the hand-painted Zeolite tie that Mr. Wagner has?

* * *

Speaking of Sam Newkirk, as I so often am, I must tell you about another of his letters, which went as follows: "I see you give two awards for participation in your recent contest (to decipher K. G. Wbakgm). It is assumed that a subscription to W. & S. W. and a breakfast contain the same nutriment and are equally digestible." And, Sam, your puzzle was solved in the *Readers' Digest*.

* * *

What's in a name? Herb Moore, who resumed his consulting sanitary engineering practice last October after several years of service in ETO, picked an office building at the corner of *Water* and *Wells* Sts. in Milwaukee.

* * *

All is not gold that glitters, or something. We were sitting in the Memorial Union Building at Purdue

SLUDGE FACTS FROM EXPERTS
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Superintendent O'Dell of the modern sewage plant at Wisconsin Rapids, Wis., really praises his Royer—local park board takes most of his fertilizer output; the rest is available for golf courses and growers.
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PIONEERS IN THE SALVAGE OF SEWAGE SLUDGE

University. It was the 38th meeting of the Indiana Sect., A. W. W. A., and *we* were N. S. "Jo" Chamberlin of W & T, L. E. "Wick" Wickersham of Am. Water Works and Elect. Co., and I. Jo told the story of the water plant operator who, having carefully set up his chlorinator, connected up a tank of gas. Gradually easing up the dosage, he waited for a residual to appear in the treated water. No residual, so up went the dosage. Still no residual. Up went the dosage again, and still no residual. A check of all parts indicated that the machine was functioning properly. And so he raised the dosage once more. Boy, what a chlorine demand! How long can this go on? When the maximum capacity of the machine was reached, a frantic call went forth to W&T, who dispatched a man forthwith.

Of course, he couldn't expect to obtain a chlorine residual, combined, free, or otherwise.—The gas he was using was Freeon.

Wick countered with a good story, but that will have to wait for the present.

* * *

Good Memory. Paul Farrell, Secy. of the Ky.-Tenn. Sect., A. W. W. A., writing in the Nov. issue of "Chats with Water Works Folks" (the Section News letter) said, "In the past we have refrained from discussing sewage in this bulletin, but since sewage and industrial waste treatment works are, as Linn Enslow once said, 'in reality water supply protection works,' it does not appear that the following is out of order: On Oct. 30, 1946, members of the Ky.-Tenn. Sect., A. W. W. A., and others met and organized the Ky.-Tenn. Industrial Wastes and Sewage Works Assn." Paul Farrell has a good memory—Linn Enslow said that quote in an editorial nearly six years ago.

* * *

Skyscraper lake. A story in *Intake*, the house magazine of Sam Morris' Los Angeles Water Dept., tells about the highest lake in the North American Continent. Little Lake Tulainyo, at elevation 12,865 ft., cops the honors. Not that the lake is used for water supply; it is frozen solid most of the year, but stocked with fish it is a popular place in August with the fisherman, in spite of the fact that it can only be reached by fifteen miles of pack trail. The name of the lake is a coined word, from Tulare and Inyo counties. (Tulare County also

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gave its name to tularemia—rabbit fever.) Even Lake Titicaca in Peru and Bolivia is 365 ft. lower than Tulainyo, but its 3,800 sq. mi. makes it the largest high lake. It has no fish life. (O. K. School's over for this month.)

* * *

Small World No. 2. It was raining one day as I drove to the station to take the train to work and I picked up a couple of neighbors on my block. In casual conversation, I mentioned that I had just returned from a water works convention.

One of my passengers said, "Are you connected with the water works field?"

To which I replied, "Yes, I'm a columnist for *Water & Sewage Works.*"

"Do you know my uncle?"

"Not Charles Burdick of Alvord, Burdick and Howson?"

"Yes, I used to live with him."

Well, well. Small World.

* * *

From *Over the Spillway* (Illinois) recently: "It's all a matter of policy—during the strike of city employees the other day, union officials ruled that Delmar Riser, chief water operator, could not work. They did permit the zookeeper to stay on, however, because they claimed the animals needed to be fed."

* * *

When I unpacked my bag recently I came across a business card that had slipped into a pocket. It read, "P. D'Gerolamo, Purchasing Agent and Asst. Mgr., East Jefferson Waterworks District No. 1, Metairie, La." That brings back memories of the AWWA meeting in St. Louis and an evening at the Statler Hotel. Will I see you in 'Frisco next year, D'Gerolamo?

* * *

Touché! (This is really my story even though you may have read it in "Swede" Larson's piece in the recent issue of the CSSWA *Windmill.*)

At breakfast in the Royal York Hotel (Oct. Federation Meeting in Toronto), C. C. "Swede" Larson, Blucher Poole, Rolf Eliassen, and I were indulging in the great American game of kidding the waitress.—From her burr, she obviously was from the land of that delightfully smoky liquid spelled . . . sky. "Swede" spoke first, "What part of Scotland are you from?"

"From Glasgow," came the soft, rich answer.

At which Rolf piped up with, "I was in Glasgow during the war and I don't think much of it!"

"Glasgow doesn't care," came the soft burr again.

Touché!

* * *

More Codes: When I put that item in about who is K. G. Wbakigm, I expected a few answers (more than the two I got), but I didn't expect to receive a letter from some "bum" in Brooklyn with an even worse mess of letters. That one was addressed, "Dear Kelt, and was signed, Ioeuv yours, Aske Dnwya, Lrti." Sorry, mister, if you are offering me $10,000 I'll never know it, because in thirty minutes I couldn't figure it out.

* * *

On Me. We were sitting around the press table provided at the Toronto Meeting of the Federation (*We* being Bill Foster of *American City,* Herbert Orland of *Engr. News Record,* and Miss Dunn of J. P. Russell's *Water and Sewage,* and I, and I couldn't resist an urge to compliment Miss Dunn on the styling of her hair (blonde, too)—to which, after looking at my pate, Miss Dunn replied, "There's a lot of it, too." Touché!

* * *

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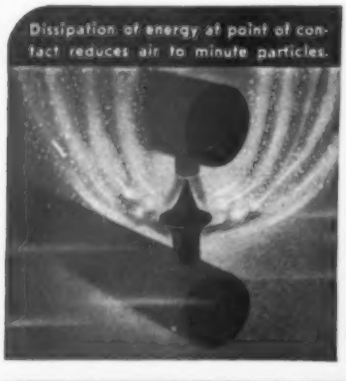

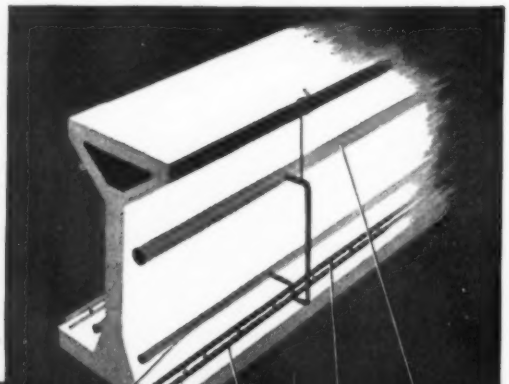

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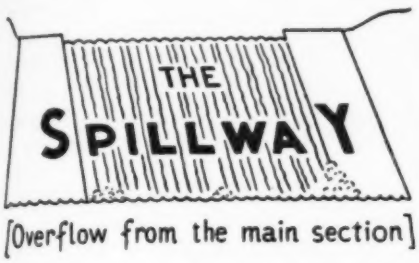
Sorry—that special announcement I promised you a couple of months ago is being delayed once more.—Even the annual index over which I slaved for that December issue was a victim of the printers' strike and had to be held over for publication in January. I suggest you paste it in the back of the December issue right now. V.T.Y. Doc.



[Overflow from the main section]

Lee Purcell Opens Consulting Office

Lee T. Purcell, Analyst and Sanitary Engineer of the North Jersey District Water Supply Commission, Wanaque, N. J., has opened an office as a Consulting Sanitary Engineer.

Mr. Purcell will offer services on Water Purification, Sewage Disposal, Industrial Waste Treatment, as well as Swimming Pool Control, Lake Treatment, Supervision of Construction and Operation, and Complete Laboratory Services.

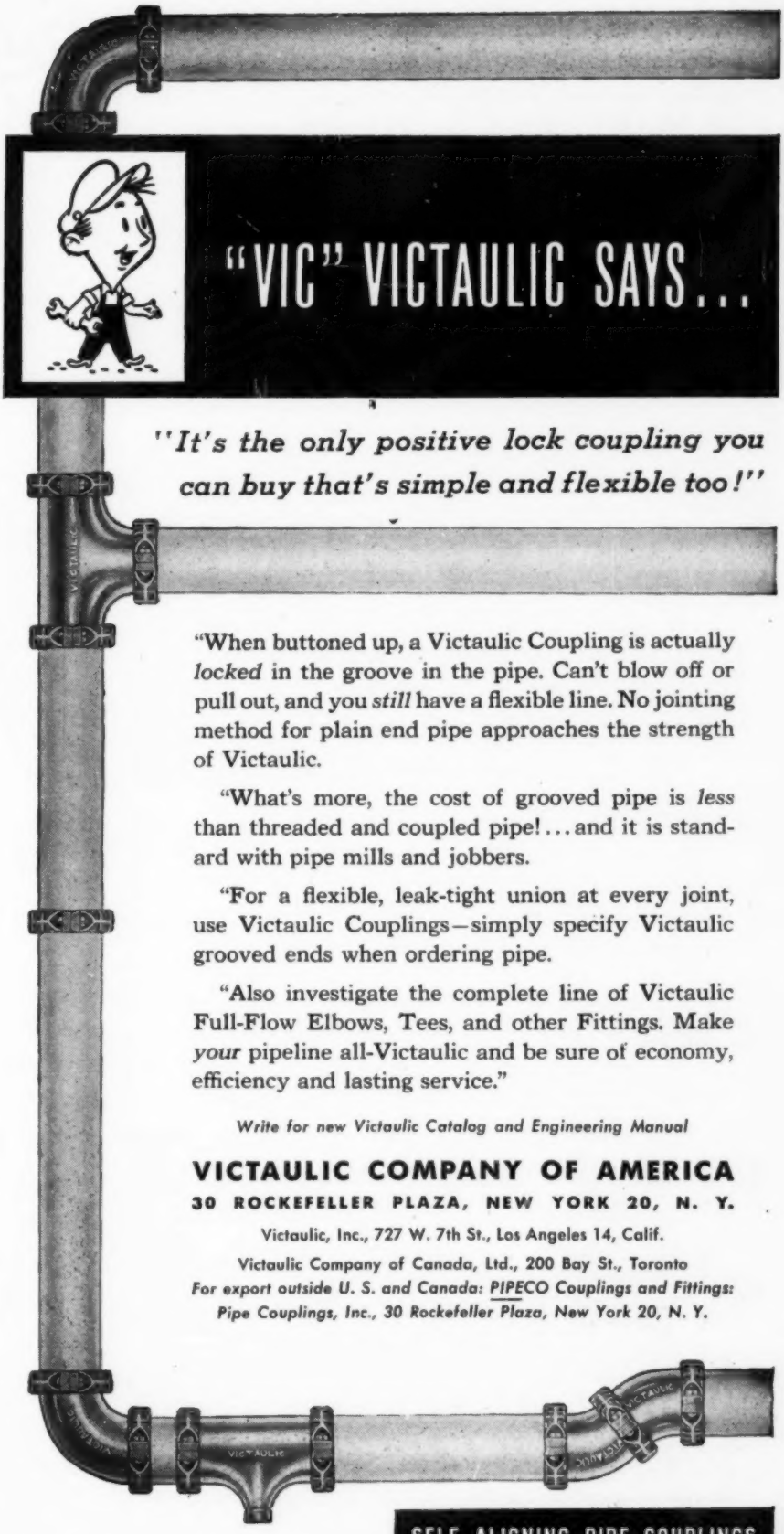
He will remain as Consulting Sanitary Engineer to the North Jersey District Water Supply Commission.

Correction!!!

In the article by R. W. Angus, on page 321 of the Nov. 1945 issue, and unfortunately repeated in the Reference and Data issue in April 1946 on page R-75, the formula for Specific Speed was incorrectly shown. The correct formula for Specific Speed is:

$$N_s = \frac{N\sqrt{G}}{H^{0.75}}$$

We are indebted to a reader in Australia for calling this error to our attention.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Indianapolis Offering Sewer Service to Outlying Areas

Schedule of Service Charges Developed

The Indianapolis (Ind.) City Board of Works and Sanitation has adopted a fee schedule of charges for connecting suburban non-resident domestic users to municipal sewer lines. The charges became effective Jan. 1, 1947.

The fees will be $6 a year per family unit, or $44 per million gallons of metered sewage admitted to the city's system. A recent survey disclosed that 28 separate homes and commercial buildings were already connected to the city sewer system without paying for the service. These users are expected to pay when the fee system goes into effect. Several government-owned plants have heretofore not been required to pay the sewer service charge. These include Plants 5 and 6 of the Allison Division, General Motors Corp., Bridgeport Brass Co., and the aviation and housing facilities of Sout Field.

This recent action by the city ends years of neglect to open its sewer system to "outsiders" on an economically sound basis. The charge system was perfected by City Engineer Thomas R. Jacobi and the engineering firm of Moore & Owen, which is now studying the Indianapolis metropolitan area's sanitary needs and is developing a long range modernization program.

A stimulant to the quick installation of the fee system was brought about by the growing number of usurpations by outsiders of the benefit of city tax-supported public services without paying for them. Board members are of the opinion that the action will encourage hundreds of out-of-the-city home builders to connect to the city's sewer lines rather than to install septic tanks.

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— PEERLESS MIXED-FLOW PUMPS

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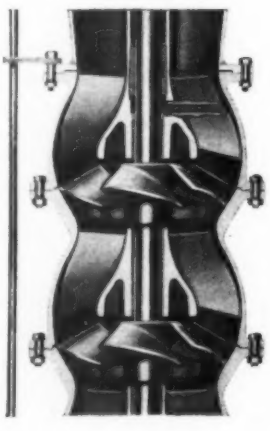
Numerous successful applications of Peerless Mixed-Flow Pumps include: drainage; sewer and flood control service; de-watering; irrigation water diversion; flooding of agricultural lands; industrial and process work including condensers, circulation of liquors, etc.



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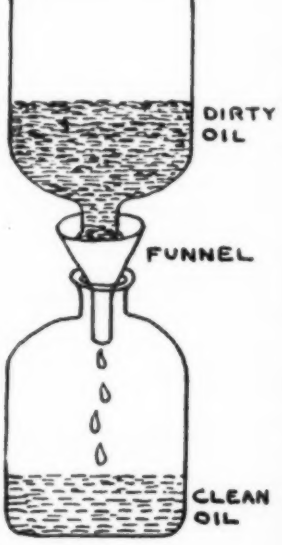
Home-Made Oil Filter*

A simple oil filter is shown in the sketch herewith. Two bottles, a funnel and some filtering materials are all that were needed. Anybody can make and operate one. Put the dirty oil in one of the bottles. Place the filtering materials (generally ordinary waste) in the funnel, and insert into lower bottle. Then invert the bottle containing the oil, just as is done with an ordinary water bottle. It is inverted over the funnel and placed in such position that it will gradually and automatically feed while the oil filters and will not feed any faster.



*Contributed by W. F. Schaphorst, M.E., Newark, N. J.

An advantage of this method is that as soon as the oil has filtered through into the lower bottle, the bottles may be reversed if desired and the oil refiltered. It is a simple matter to renew the filtering medium, and since the bottles are made of glass, the oil in both bottles and the operation of the filter are always clearly visible.

Sewerage Co. Ordered to Rebate Overcharges

Court Order Ends 16 Years of Litigation

Early in December the Pennsylvania State Supreme Court ordered the Cheltenham and Abington Sewerage Co. to pay $10,636.81 in reparations to residents of the two townships in Montgomery county. The court order sustained the findings of the Pennsylvania Utility Commission in a suit by the Glenside Home Protective Association contending that sewer service rates charged by the company between 1933 and 1937 were "unreasonable, oppressive, and extortionable."

The court ordered the rebate with simple interest at six per cent for the period of August 30, 1935 to December 31, 1936.

This Superior Court Ruling ended 16 years of litigation instituted by the P.U.C. and the Glenside Association in 1930.

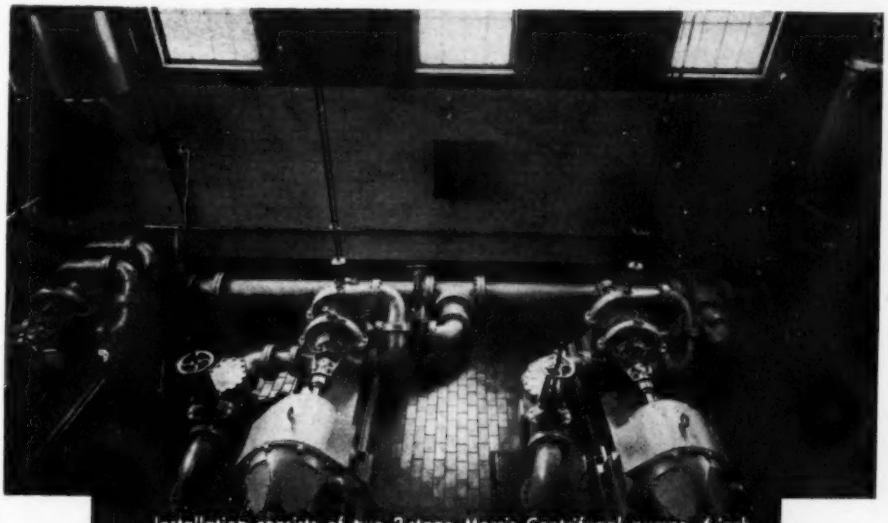
Allegheny County Sanitary Authority Leads the Way in Penna.

The Allegheny County Sanitary Authority, located in and around Pittsburgh, has reported that 67 municipalities have signed agreements with the Authority delegating to that body authority to plan for sewage treatment for those communities. Agreements with seven other municipalities are pending and 15 industries have entered into agreements with the Authority to have their industrial wastes diverted to the sewage system to be operated by the Authority.

The Allegheny County Sanitary Authority probably represents one of the most difficult and expensive engineering undertakings of its kind in the country. To date more than 4,000 analyses of samples of sewage and wastes have been made and about an equal number are still to be made to complete the preliminary work determining the location of intercepting sewers.

Pumping Concord's Water

FOR 15 YEARS...



Installation consists of two 2-stage Morris Centrifugal pumps, 6-inch suction, 6-inch discharge, connected in series, driven by Westinghouse 125 H.P. motors at a speed of 1740 R.P.M.; capacity of each unit 1145 gallons per minute with suction lift of 15 feet and discharge head 286 feet.

The third unit is a 3-stage Morris Centrifugal pump connected in series, driven by a 175 H.P. Sterling Dolphin gas engine, 1200 R.P.M., 1145 gallons per minute.

MORRIS CENTRIFUGAL PUMPS

In 1930, the contract for pumping equipment in the new Meadow Station at Concord, New Hampshire, was awarded to the Starkweather Engineering Company of Newtonville, Mass. Three Morris Centrifugal Pumps were then installed—fifteen years ago.

Since then the Morris Pumps have given such excellent service, according to Mr. Percy R. Sanders, Superintendent of Concord Water Works, that the Town engineers recently ordered and now have in operation, a fourth Morris Pump for the main station.

Another example of **Morris Service with Efficiency**

There is a Morris Pump for every job. Write us for specification and operation data best suited to your needs. No charge or obligation.

MORRIS MACHINE WORKS
Baldwinsville, N. Y.
Sales Offices in Principal Cities

MORRIS *Centrifugal Pumps*

In the program of the State of Pennsylvania to clean up its streams there have been 531 municipalities and 426 industries ordered to prepare plans for waste treatment. Most of these plans are now underway. A few laggards who have not started work have been cited by the State and work is expected soon to be underway in all cases.

Among the larger projects is the enlargement and improvement of the Northeast sewage treatment works in Philadelphia. Easton, Pa., is one of the larger cities receiving a grant in aid for the cost of preparing the plans for sewage treatment work.

In addition to the planning and construction of sewage works, the work on the sealing of abandoned coal mines to prevent formation of acid is proceeding. Additional work has been done since the last report in the November issue of *Water & Sewage Works.*

It may truly be said that the State of Pennsylvania and its Allegheny County Sanitary Authority are among the leaders for a clean-up of streams, a clean-up which will undoubtedly sweep throughout the country in the next several years.

OVER 600 ACCELATORS

NOW IN SUCCESSFUL OPERATION

A Proven Principle of Water Treatment

The soundness of the exclusive Accelator principle of water treatment is being demonstrated daily in over 600 installations. There is nothing new or untried about it.

The principle involves the maintenance of a slurry pool at a constant level for varying flow rates and slurry concentrations so that clear, treated water will separate at a high rate at the surface of the slurry pool. This is accomplished by mixing one volume of raw water and chemical with approximately 15 volumes of previously formed slurry in the primary chamber, and the gentle discharge of 3 to 5 volumes of this mixture at the surface of the slurry pool. One volume separates and rises from the surface of the slurry pool, while the larger volume passes downward and back into the primary chamber. Excess solids are continuously concentrated and automatically discharged. Thus, the separate steps of quick mixing, coagulating, settling and sludge removal of older methods are combined in one compact unit.

This modern, streamlined water treating process applies the "Know-How" gained by Infilco engineers from many years of intensive research and development. Ask for Accelator Bulletin No. 1824. INFILCO Inc., 325 West 25th Place, Chicago 16, Illinois.

ADVANTAGES

- Space Saving
- Lower Construction Costs
- Longer Filter Runs
- Automatic Sludge Removal

CONSULT INFILCO — FIRST IN WATER AND SEWAGE TREATMENT

MANUFACTURERS' and EQUIPMENT NEWS

Cathodic Protection for Hot Water Tanks

Westinghouse Electric Corp. has announced the development of a cathodic protection system for hot water tanks. This is done by the simple expedient of suspending inside the tank a magnesium-alloy electrode electrically grounded to the tank. Galvanic currents are such that ions flow away from the magnesium electrode instead of from the tank wall, thus destroying the magnesium instead of the zinc coating on the hot water tank. This is a sacrificial anode type of treatment long known in cathodic protection.

Further information may be obtained from Westinghouse Electric Corp., 306 Fourth Ave., Box 1017, Pittsburgh 30, Pa.

Broggi Now Neptune's General Manager

The Neptune Meter Company has announced the appointment of Dante E. Broggi, vice president and director, as General Manager of production, sales and research.

Mr. Broggi, a graduate of City College in New York, began work for the company as chemist and metallurgist in 1920, later being promoted by successive steps to the position of Factory Manager.

John Woodson to Represent Hydraulic Development

John T. Woodson has been appointed representative of the Hydraulic Development Corp. for Virginia and

North Carolina, according to an announcement by Reginald Hayes, Gen. Sales Mgr. of the company.

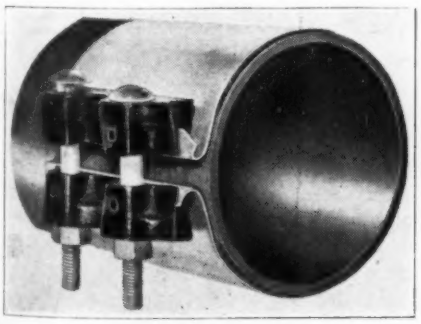
Mr. Woodson established himself last year as a manufacturers' representative and is located at 506 Independence Bldg., Charlotte, N. C. Prior to the opening of his own business, Woodson was southern sales manager for Clow National Pipe and was sales manager for the Lynchburg Foundry Co. before that.

Mr. Woodson will stock both Hydro-tite and Fibrex in Charlotte.

Pipe Leak Repair Clamp

A new pipe leak repair clamp has been introduced by Smith-Blair, Inc., of San Francisco.

The clamp has features which make it possible to seal off leaks in pipe lines both quickly and permanently and is produced in sizes for pipe from ½ to 30 in. in diameter. It is adapted for all types of metallic pipe and for asbestos cement pipe.



The clamp has a copper band sleeve which gives about 100 per cent wraparound without using a tongue. A unique feature of the design is the cast lugs which can be reduced in length for 30 in. sleeves down to 3 in. sleeves in even multiples of 3 inches. This change can be accomplished in the field without special tools.

Further information on this pipe leak repair clamp may be obtained from Smith-Blair, Inc., South San Francisco, Calif.

Gage to Measure Pipe Thickness

The Special Products Division of the General Electric Co. has developed a pipe thickness gage which will measure the thickness of iron or steel pipes from the outside.

This gage, Type MS-A, can be used on pipes up to ¼ in. in thickness and from 1 to 2 in. in diameter. The instrument operates on 115 volt, 60 cycle power and gives an accuracy of plus or minus 1/64 in. on clean surfaces, or 1/32 in. on dirty surfaces.

Further information on this G-E gage for measuring the thickness of pipes may be obtained from the General Electric Co., Schenectady, N. Y.

11 miles...

MIRAFLORES—Canal Zone

GAMBOA—Canal Zone

...at a STRETCH

CLEANED BY NATIONAL

NATIONAL Know How PAYS

BEFORE

AFTER

Changes in pipe diameter, grades, bends and valves did not stop the National Water Main Cleaning Co. from cleaning eleven miles at a stretch in a line between Gamboa and Miraflores, Panama Canal Zone. The machine first traversed seventeen thousand feet of 30" pipe; opened automatically to clean the next nineteen thousand feet of 36" pipe, passing through 30" gate valves enroute; and then, without slackening speed, passed into a 30" line and cleaned another twenty-one thousand feet. Thus, the entire fifty-eight thousand feet were cleaned with but a single entry. The machine's operation was controlled by telephone and two-way radio. There was no interruption in service and the longest shut-off was eleven hours.

The technical skill and experience that enable National to perform this feat will enable us to clean your mains more effectively, with fewer pipe openings, in less time.

THE NATIONAL WATER MAIN CLEANING CO.

50 CHURCH STREET, NEW YORK 7, N. Y.

ATLANTA 3, 1221 Mortgage Guarantee Bldg.
BOSTON 15, 115 Peterboro St.
CHICAGO 6, 205 W. Wacker Dr.
KANSAS CITY 2, 3707 Madison St.
MEMPHIS 3, 519 Farnsworth Bldg.
MONTREAL 2, 2028 Union Ave.
OMAHA 5, 3812 Castellar St.
RICHMOND 19, VA., 210 E. Franklin St.
ST. LOUIS 17, 7103 Dale Ave.
SAN FRANCISCO 5, 501 Howard St.
WACO, TEXAS, The Rohan Co., Inc., P. O. Box 887
WINNIPEG, 576 Wall St.
MAYAQUEZ, P. R., Americo Rodriquez, Inc., P. O. Box 749

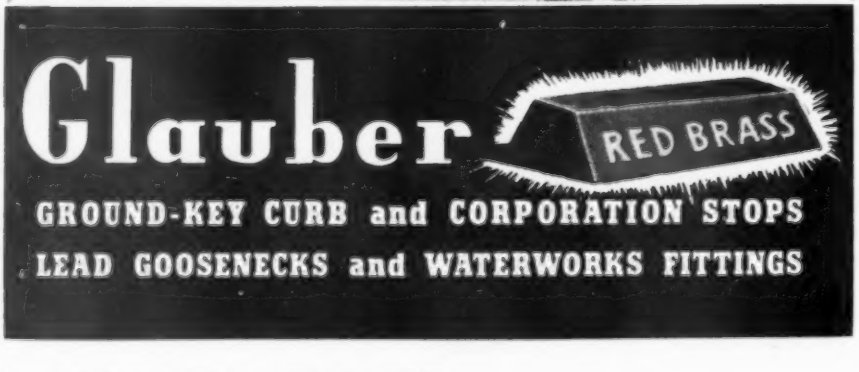
Recorder Chart Legibility Improved

Bailey Meter Co., Cleveland, has recently introduced recorder charts printed in neutral gray. This makes it easier for operators and supervising engineers to read the charts because of the greater emphasis given the various colored records by the neutral background. The new charts are especially valuable on recorders installed where lighting is poor or where it is impossible to get a clear view of the chart. The improvement in legibility is especially apparent with the dark colored recorder ink normally used, such as red, blue and green.

Hooker Sets Up Retirement Program

The Hooker Electrochemical Co. of Niagara Falls, N. Y., has inaugurated an employee's contributory retirement program. The program is designed to provide benefits which together with Social Security will approximate 50 per cent of the average earnings for employees who retire at their normal retirement date after 25 or 30 years of service. The company also maintains group insurance and sickness and disability benefit plans.

FLARED JOINT
Glauber FLARED OR PATENTED BEAD JOINTS ASSURE A POSITIVE SEAL AND PERMANENT INSTALLATION
Avoid costly "opening up" operations by using Glauber patented bead and flared joints on your initial service line installations. These connections are designed to securely lock the pipe into place when the coupling is tightened, a feature which makes loose or leaking joints impossible regardless of shifting ground mass or high water pressures. These self sealing features are basically illustrated by the accompanying sectional views. For complete specifications on your waterworks requirements write to—
THE Glauber BRASS MFG. CO.
KINSMAN, OHIO
Division of H. B. Salter Mfg. Co., Marysville, Ohio
PATENTED BEAD JOINT



Drummond and Bennett New Mathieson Vice Presidents

The Board of Directors of The Mathieson Alkali Works has elected D. W. Drummond and Arthur T. Bennett as Vice Presidents. Mr.

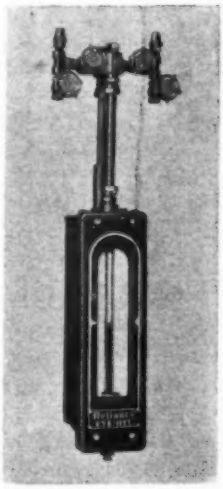
D. W. Drummond A. T. Bennett

Drummond's new title will be Vice President-General Manager of Sales, and Mr. Bennett's title is Vice President-General Manager of Operations.

At the time of his election to his new post, Mr. Drummond was General Manager of Sales; and Mr. Bennett has been General Manager of Operations since 1943.

Liquid Level Indicator

The Reliance Gauge Column Co., Cleveland, has announced a new model of the Eye-Hye Remote Read-



ing Liquid Level Indicator. The construction of the device has been altered from previous models to achieve greater compactness and certain

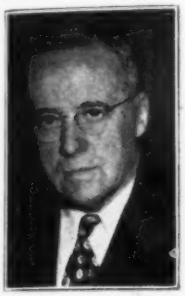
structural advantages. A plastic diffusing screen improves distribution of the interior illumination. The case is now drip-proof and the arrangement of the interior more accessible for cleaning and renewing the illuminating lamp.

Further information on the new Eye-Hye Model E-32 may be obtained in Bulletin 452 of The Reliance Gauge Column Co., Cleveland, Ohio.

Permutit Names Four Vice Presidents

W. Spencer Robertson, Chairman of the Permutit Company, New York, has announced that four executives of the company have been elected as vice presidents.

The new vice presidents include J. D. Yoder, previously with Cochrane Corp. as vice pres. and general manager, and since 1936 manager of Permutit's Boiler Feedwater Division; D. J. Saunders, manager of industrial sales (Dan Saunders is well known in the water and sewage works field as vice pres. of the Water and Sewage Works Manufacturers' Assoc. and a member of the Association's Board of Governors); G. N. Proctor, manager of manufacturing; and H. L. Beohner, technical manager since April, 1946.



J. D. Yoder

D. J. Saunders

G. N. Proctor

H. L. Beohner

Stuart-Brumley Opens Miami Office

Fred E. Stuart, President of Stuart-Brumley Corp. of Baltimore, has announced the opening of a branch office at 1211 Congress Building, Miami 32, Fla., for the convenience of customers in that area.

Mr. Stuart advises also that experimental work on their Electronic Coagulator is continuing, and that a 50,000 gallon a day plant is being installed to operate alongside of the same capacity regular alum treatment plant. It is expected that within 12 months comparative data will be available.

New Chemical Service Diaphragm Motor Valve

Fischer & Porter Co. of Hatboro, Pa., has announced a new design in diaphragm motor valve construction. These valves, known as the Valvrator, are an outgrowth of the recording-controlling Flowrator instrument, manufactured by the company.

The valve is made only in 150 lb. construction in sizes from ¼-in. to 1-in. screwed, and from 1-in. to 3-in. flanged.

Complete details of the Valvrator line are available from the Fischer & Porter Co., Dept. 9F, Hatboro, Pa.

Changes at Dorr Company

Mr. John V. N. Dorr, President of The Dorr Co., New York, has announced the appointment of Elmer R. Ramsey, formerly Vice Pres. in Charge of Engineering, as Operating Vice President; and of J. Delano Hitch, Jr., formerly Manager of the Foreign Sales Division, as Vice President in Charge of Sales.

SIMPLEX

INCREASE FLOW CAPACITY 40% TO 60%

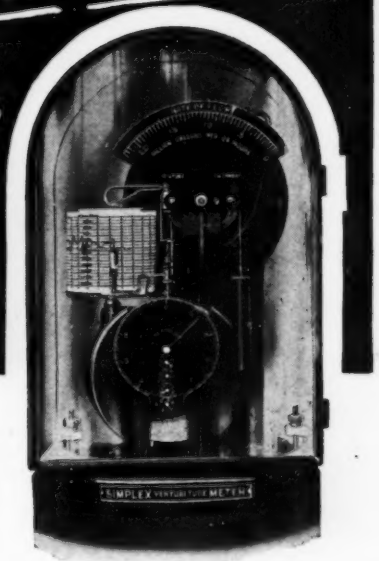
MOL or MOLA METERS

with flow ranges

FROM 20 to 1

TO 28½ to 1

OR TO 40 to 1



Two typical examples of the ease and economy of increasing the maximum capacity of flow lines with the use of Simplex MOL and MOLA wide-range meters are given below:

1. A change in operating heads enabled a large municipal water department to increase the total capacity of one of their pumps from a maximum of 60 million gallons per day to 72 million gallons per day by replacing the existing Simplex MO Meter with a Simplex MOL Meter. No change in the Venturi Tube, Pump Impeller, or motor was required, and operating costs showed a marked decrease.
2. By substituting an MOLA Meter for an MO Meter, increased requirements were met without any change in the Venturi tube, permitting an increase of from 13 million gallons per day to 21 million gallons per day.

Simplex MOL and MOLA meters are designed to function over extremely wide flow ranges — and the accuracy of measurement and totalization is maintained at both maximum and minimum ends of the range.

Look into the advantages and economies of making use of Simplex instruments for performing the extraordinary as well as the conventional metering operation.

Write today; our recommendations are made without obligation.

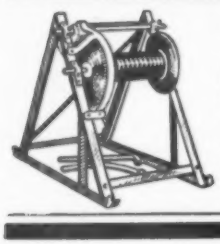
SIMPLEX VALVE & METER CO.

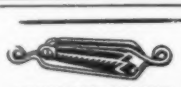
6745 UPLAND STREET, PHILADELPHIA 42, PA.

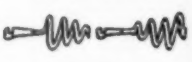
AMERICAN GAS BOILERS
STEAM AND WATER TYPES
for Digester Heating
FOR RATINGS AND DATA SEE OUR PAGE IN THE 1946 ANNUAL REFERENCE SECTION
American Radiator & Standard Sanitary Corporation, Pittsburgh 30, Pa.
AMERICAN-Standard
HEATING PLUMBING
Serving the Nations' Health and Comfort
SALES OFFICES IN PRINCIPAL CITIES

for CONCRETE and STEEL!
Inertol
Protection
Means Lowest Cost
Per Year
INERTOL COMPANY, INC. NEWARK 5, NEW JERSEY and SAN FRANCISCO 7, CALIFORNIA

Leopold
GLAZED FIRE CLAY TILE FILTER BOTTOM
Non-Corrosive—Permanent
DRY CHEMICAL FEEDERS
Accurate—Dependable
also
COMPLETE WATER TREATMENT EQUIPMENT
F. B. LEOPOLD CO., INC.
422 FIRST AVE. PITTSBURGH 19, PA.

Your
PIPE CLEANING
PROBLEMS SOLVED

STEWART STANDARD WINDLASS
Frame. Sturdy angle iron construction. Cable drum holds 1100 ft. of 3/8" cable. Shipping weight without cable 250 lbs.

STEWART STEEL SECTIONAL ROD

STEWART GUARD CAGE COLLAPSIBLE BUCKET

NO. 9A STEWART WELDED ROOT CUTTER

NO. 11—SCREW
NO. 22—SPEAR SCREW
For information write for catalog.
Canadian Distributors: W. H. Cunningham & Hill Ltd., Toronto.
W.H. STEWART
1051 SOUTH CLINTON ST.
SYRACUSE, N.Y.

A. Peterson, Ch. Engr., De Laval, Dies

Arvid Peterson, Chief Engineer of the Centrifugal Pump and Compressor Division of De Laval Steam Turbine Co., died in December. Born in Spaneholm, Sweden, Mr. Peterson was a graduate of the Royal Polytechnic University of Sweden, and came to this country in 1905. He was employed by De Laval in 1907 and had been Chief Engineer from 1926 until his death.

Micromet Feeders for Industrial Use

The Calgon Company of Pittsburgh has developed Micromet feeders for commercial, institutional or industrial establishments. These feeders, which are an extension of the original household Micromet feeder developed last year, hold from 20 to 100 pounds of Micromet at a charge. The chemical, which is a modification of Calgon, dissolves at a rate of 25 per cent per month, and the range of sizes available makes it possible to treat as low as 3,000 or as high as 1,000,000 gallons per month.

Further information on the Micromet feeders may be obtained from Calgon, Inc., 323 Fourth Ave., Pittsburgh 30, Pa.

Marlow Pumps to Have Own Airport

Marlow Pumps at Ridgewood, N. J., is constructing a private airport. A 100-acre modern facility owned by members of the Marlow family, the new field will be made available for general use as soon as licensing arrangements are made. Located in the southeastern section of Ridgewood but ten minutes from the plant, it is planned to use the airport for closer and quicker contact by representatives of the company with its marketing contacts.

Caplan Returns to Hagan Corporation

Louis R. Caplan, Washington representative of the Hagan Corporation until he went into the army, has

returned to that position to represent Hagan-Hall Laboratories and Calgon, Inc. During his absence the post was filled by George H. Larkin, who has now taken over the company's Cincinnati office. During the war Mr. Caplan served in the Sanitary Corps.

American Meter's Service Guild Gains Five New Members

The American Meter Company's 25 year Service Guild recently gained five new members when Norton McKean, President, awarded recognition to Leo Rivers, George A. Nicklas, George W. Winne, Arthur M. Manweiler and Charles C. Schlosser.

The Guild in the Albany plant (D. McDonald Works) now has 72 members, comprising approximately 14 per cent of the personnel. Mr. Bernard J. Holtslag is senior in point of service, having joined the company in 1886.

Link-Belt Establishes Milwaukee Office

Link-Belt Co. has announced the opening of a sales office in Milwaukee, under the management of William M. Hufnagel, district sales manager. Mr. Hufnagel has been with the company since 1924, and since 1943 has been district sales engineer handling all company products in Chicago.

CEMENT GUN COMPANY

"GUNITE" CONTRACTORS

GENERAL OFFICES—ALLENTOWN, PENNA., U.S.A.

DAM REBUILT WITH "GUNITE"

This is Lower Doughty Pond Dam belonging to the Atlantic City, New Jersey, Water Department, a poured concrete structure with fresh water upstream and tide water at the downstream toe. This structure became seriously disintegrated and eroded as shown in the left hand photo, and was completely restored with "GUNITE" a minimum of six inches in thickness with double mesh reinforcement.

The right hand view shows the finished job completed by us in 1941. Both the upstream and downstream faces were restored with "GUNITE," as well as the wing walls.

Our 72-page general bulletin C2300 describes this and scores of other uses of "GUNITE." We will be glad to send it to you upon request.

MANUFACTURERS OF THE "CEMENT GUN"

84" pipe—Spring Lake, N. J.

FLANGED PIPE

FLEXIBLE JOINT PIPE

BELL & SPIGOT PIPE

SPECIAL CASTINGS

SHORT BODY BELL & SPIGOT SPECIALS

Large stock enables us to make prompt shipments.

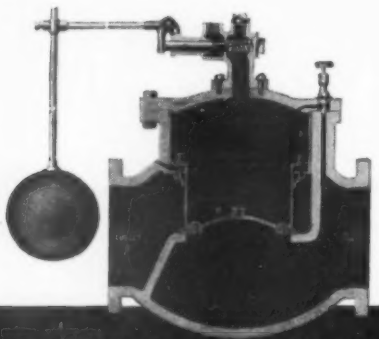
CAST IRON PIPE

SIZES 2" TO 84"

Warren Foundry & Pipe Corp.

11 Broadway, New York

Warren Pipe Company of Mass., Inc.



GOLDEN-ANDERSON
HIGH PRESSURE
COLD WATER
Float VALVES

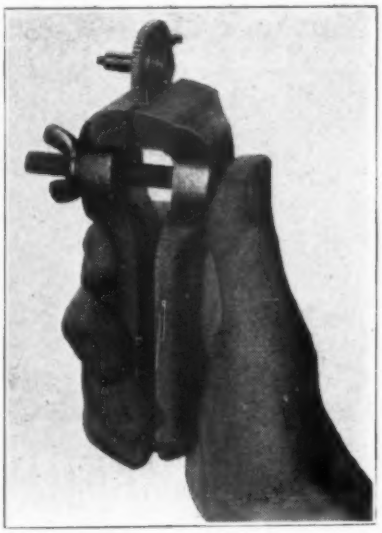
Available in standard sizes from 3 inch to 36 inch, in Angle and Globe Patterns—iron, semi-steel, and cast steel bodies with non-corrosive trim of bronze, Gavalloy or Stainless steel.

100-page descriptive Catalog, free on request.

GA
GOLDEN-ANDERSON
VALVE Specialty Company
PITTSBURGH 22, PA.

Hand Vise for Small Pieces

The Chicago Tool and Engineering Co. has introduced a new hand vise for small pieces. Only 7 ounces in



weight and 5 inches long, it is light and comfortable to hold. The 1½ in. wide jaw faces open to 1½ inches and are accurately machined to provide a true surface.

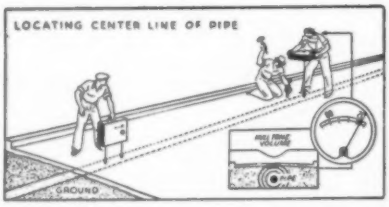
This item, known as the Palmgren No. 15 Hand Vise, may be obtained from the Chicago Tool and Engineering Co., 8383 South Chicago Ave., Chicago 17, Ill.

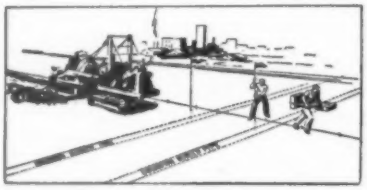
Have you seen?
the PITTSBURGH · EMPIRE COMPOUND
a revolutionary NEW meter with many advantages

PATENT APPLICATION MADE

Ask for Bulletin W-803
Pittsburgh Equitable Meter Division
ROCKWELL MANUFACTURING CO.
Pittsburgh 8, Pa.

M-SCOPE





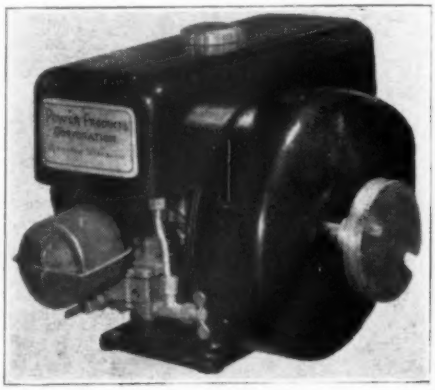
BURIED PIPE AND CABLE FINDER

16 PAGE BOOKLET FREE UPON REQUEST

FISHER RESEARCH LABORATORY
Palo Alto, California

New Light Weight Gasoline Engine

The Power Products Corp. of Grafton, Wis., has announced the development of a new light weight compact aluminum gasoline engine. This one horsepower engine, 8½x11x14½



inches in size, weighs only 16 pounds and was designed for those who have need of portable and self-propelled equipment, such as compressors, pumps, floodlights, lawn mowers, bicycles, etc.

Emphasis has been placed on compactness so that the engine will take

HYDRO-TITE

HYDRO-TITE—The self-caulking joint compound that makes cast iron water pipe joints—strong—tight—flexible and everlasting. Used on thousands of miles of pipe with a record of more than 30 years without a failure.

FIBREX—The sanitary paper packing that is used like braided jute. Free from bacteria—treated with a water repellent—put up in 60 pound reels. 70 pounds of Fibrex takes the place of 100 pounds of braided jute.

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WRITE FOR INFORMATION

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A.W.W.A.

VOGT BROTHERS MFG. CO. Incorporated LOUISVILLE, KY.
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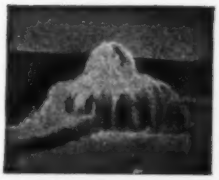
P. O. BOX 1122

AERO-MIX

AERATOR—MIXER

A Size and Type to Fit Your Problem In Water or Sewage Treatment.



WRITE FOR INFORMATION

up a minimum of space. Other features include smoothness at all speeds, easy starting, minimum noise and vibration, and good operation at any tilt up to 45 deg. The engine is of 2 cycle, air cooled design. Aluminum castings and stampings are used throughout, except for piston rings, cylinder sleeve, crankshaft, bearings, etc.

Further information on the new light weight aluminum gasoline engine may be obtained from the Power Products Corp., Grafton, Wis.

RUSTREM for Rusty Surfaces

The Speco Co., Inc., of Cleveland has announced a new type of industrial paint which can be applied directly over rusty surfaces without

cleaning or scraping. Known as RUSTREM (rust remedy), this new black paint is said to seal rusty surfaces and to stop rust permanently. The paint is said to be effective under water or exposed to moist atmosphere. If these claims are true, this material should certainly find wide application in water and sewage works.

We suggest that you write to Speco, Inc., 3142 Superior Ave., Cleveland, Ohio, for further information on this new paint.

A. F. Wirtz of Atlas Mineral Products Passes

The Atlas Mineral Products Company of Mertztown, Pa., has announced the untimely passing, on December 16th, of Arthur F. Wirtz, secretary-treasurer of the firm. Mr. Wirtz, who was forty-six, died suddenly of a heart ailment. He had been with the company since 1921 and had been an officer since 1926.

FOR BETTER
pH Control
and WATER TESTS
there is nothing like

NON-FADING GLASS COLOR STANDARDS

Pocket Comparator No. 605

Permanent reliability of Hellige Glass Color Standards, accuracy of color comparison, simplicity of the technique, and compactness of the apparatus are exclusive features of Hellige Comparators not found in any similar outfits.

WRITE FOR BULLETIN No. 602

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NO digging; no special wrenches; no water can escape in case of damage to standpipe; stem set at bottom of valve means bending by accident won't hurt it; no freezing due to positive drip action; no complicated mechanism, one man can remove entire valve and stem easily, quickly; no water hammer, valve closes against pressure with cut-off under valve; large waterway; and—every single part made with extreme care to last a lifetime and longer. Choice of many water works men and fire chiefs.

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P.F.T. Rotary Distributors provide a practical, efficient unit for dosing sewage to filter medium, in minimum area and with minimum piping. Operate at minimum head, frequently eliminating piping. Features include patented spreader jets that assure full, even coverage of the filter bed; triple valves and a positive mercury seal. Ask for Bulletin No. 213.

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720 ft. NEW 36 Inch CAST IRON BELL AND SPIGOT PIPE CLASS "C"

Immediate Delivery
Write—Wire—Phone

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2nd & Riverview (47) Victor 9243
Kansas City 18, Kansas

Brass Cleaner

Enthone, Inc., of New Haven, Conn., has developed an alkali cleaner with high detergent ability and no tarnishing action on active metals, including copper, brass, bronze, nickel, silver, tin, and lead.

Further information on this new brass cleaner may be obtained from Enthone, Inc., 442 Elm St., New Haven, Conn.

Moulton and Buist Turco Sales Chiefs

Lou Moulton

Dan Buist

Turco Products, Inc., Los Angeles, has announced the appointment of L. H. Moulton to the post of National Sales Director, and D. T. Buist, Assistant National Sales Director of the company. Both men have been with the company a number of years and both will be located in the firm's main offices.

PCA Announces Promotion of Three

Promotion of three veteran members of the Portland Cement Association's scientific research staff, effective January 1, has been announced by Dr. A. Allan Bates, Vice President for Research and Development.

F. R. McMillan, the Association's Director of Research since 1927, is promoted to be Assistant to the Vice President for Research and Development.

H. F. Gonnerman, Manager of the Association's research laboratory in Chicago for the past 19 years, becomes Director of Research.

William Lerch, senior research chemist in the Chicago Laboratory since 1940, is promoted to be Manager of the Department of Applied Research.

These promotions were included in a general reorganization of the Research and Development Division,

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FOR
SEWAGE
AND
INDUSTRIAL WASTES
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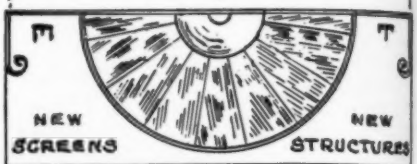

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NO COSTLY, POWER CONSUMING REVOLVING BRUSH ARMS—25% GREATER SUBMERGED AREA.

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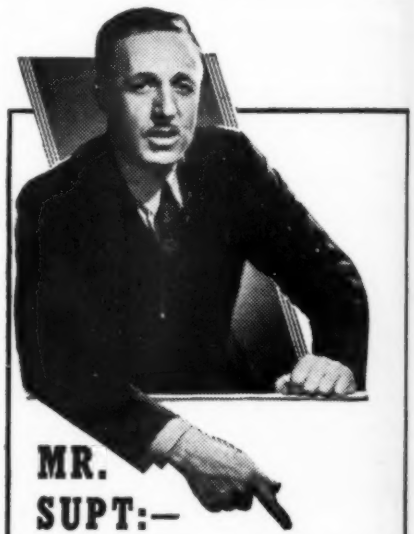

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APPLICATION 50%

GIVEN THE BEST COATING THAT SCIENCE AND SKILL CAN PRODUCE TO PROTECT METAL AGAINST THE INROADS OF RUST AND CORROSION, IT'S REAL EFFECTIVENESS DEPENDS UPON *APPLICATION*.

AS NATIONALLY APPROVED APPLIERS OF SUCH MATERIALS AS *NO-OX-ID*, *BARRETT* AND OTHER COATINGS, OUR EXPERIENCE IS HELPFUL IN GETTING YOU THE UTMOST IN PROTECTION.

WE SPECIALIZE IN THE SURFACE TREATMENT OF STEEL STANDPIPES, TANKS, WATERMAINS AND OTHER WATERWORKS AND BUILDING INSTALLATIONS.

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STOP

Meter Storage Rust

AFTER cleaning and repairing gear trains and other meter parts, dip them in a solution of Oakite Special Protective Oil before storing. This economical, indoor-rust-preventive coats surfaces with a thin, transparent film that wards off "storage rust."

FREE 16-page booklet describes ease of application and removal. Discusses the wide variety of uses. Send for a copy today.

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Technical Representatives in Principal Cities of U. S. & Canada

OAKITE

Specialized Industrial Cleaning
MATERIALS • METHODS • SERVICE

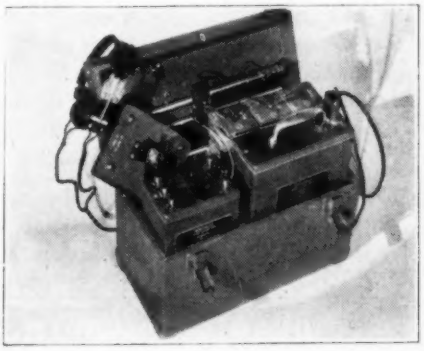
necessitated by the greatly extended research program of the Association which was announced last July.

Hiett Adv. Mgr. Gorman-Rupp

Gilmore Hiett has been appointed as advertising and sales promotion manager of the Gorman-Rupp Co., pump manufacturers of Mansfield, Ohio. Mr. Hiett was formerly advertising manager for refrigerators and home freezers with the Westinghouse Electric Co.

Pipe and Cable Locator

In announcing the "Wahlquist" Pipe and Cable Locator, the Nilsson Electrical Co. points out that the new device has many desirable features. The Model 113 set consists of a compact transmitter, receiver, headphones, batteries, and leads. The signal is easily induced in pipe or cable by the transmitter, which remains stationary. The exact location of the



pipe is determined by signal volume as the receiver box is manipulated. The exact course of a pipe and its depth can be determined, and nonconducting pipe can be located by snaking a wire through it or by using water as a conductor of electricity.

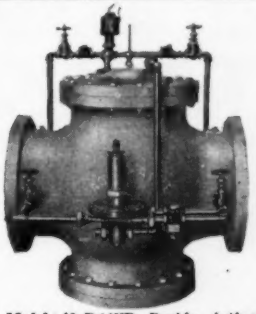
Further information and instructions for operating the "Wahlquist" Pipe and Cable Locator may be obtained from the manufacturer, the Nilsson Electrical Laboratory, Inc., 103 Lafayette St., New York 13, N. Y.

Est. 1879

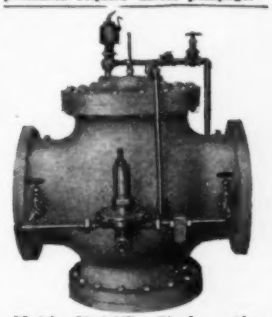
ROSS

AUTOMATIC VALVES

Altitude Valves for tank and reservoir, with two sets of controls—Automatic Hydraulic and Electric Remote Control. Hydraulic pilot normally operates the valve, while electric pilot is used for emergency only.



Model 40-DAWR Double Acting may be operated by electric pilot regardless of elevation of water in tank or reservoir, for a break in supply or distribution and when fire pressures require direct pumpage.



Model 30-AWR Single acting valve may be controlled in same manner as the Model 40-DAWR.

Model 40-AWR Single Acting semi-throttling valve will close on reversal of flow and the electric pilot would serve only a single purpose—either to open wide or close as emergency may require.

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GATE VALVE OPERATION
★ SAFE ★ RELIABLE ★ QUICK ★
By
The Dean Truck Mounted Valve Operator
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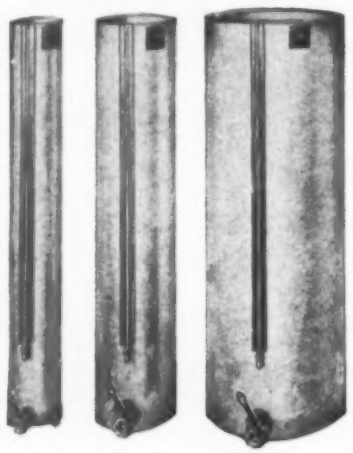

Ford Calibrated Tanks for water meter testing are accurate, durable and absolutely simple. Made in five sizes, they are calibrated in gallons and cubic feet, also in percentage fast and slow. Write for catalog containing useful information on water meter testing as well as description of calibrated tanks and test benches.

The FORD METER BOX COMPANY, INC.
Wabash, Indiana

No. 8

LITERATURE AND CATALOGS

Positive Displacement Meters

In a 16 page bulletin No. 40-B14 of the Roots-Connersville Blower Corp. is presented information on its **Rotary Displacement Meters.** The bulletin shows construction features and discusses various advantages of the meters, as well as presenting a table of sizes and capacities. These meters are built for pressures of 25, 50 and 125 lbs., in standard sizes, and higher pressures are available on special order.

The bulletin also discusses meter accessories, recorders, integrators, indicating and recording tachometers, and other instruments, along with an explanation of their uses with the R-C meters.

Bulletin 40-B14 may be obtained from the Roots-Connersville Blower Corp., 900 West Mount St., Connersville, Ind.

Meter Repair

"If you placed a dollar in your pocket and later found only sixty cents, what would you do? Drop in another forty cents, or sew up the hole in your pocket?" With this question, an article, "Sewing Up the Hole," introduces the subject of meter maintenance as a means of preventing loss of income from non-registering meters.

This article appears in the Dec. 1946 issue of **Water,** the magazine published by the American Water Works and Electric Co., Inc., 50 Broad St., New York, N. Y.

Aluminum in Water and Sewage Works

On the last page of the November issue of **Aluminum News-Letter** there are shown two items of interest to water and sewage works men. The first of these is a water tank with aluminum roof built for Macon, Ga., by R. D. Cole Mfg. Co. In the second, there is a "portrait of a hole in the ground," being in fact a view looking down into a manhole in the storm sewer system in Cuyahoga Heights, Ohio. Among the claims for aluminum manhole steps are their resistance to corrosion, lack of need for painting, and non-sparking characteristic, thereby avoiding the hazard of a gas explosion if struck by hob nails or tools.

Also shown in this issue is an aluminum ladder which may find suitable use in a water and sewage plant. And if you are a camera enthusiast, there is a camera type tripod; or if you go in for model airplanes, there is a jet propulsion engine airplane; or if you are a fisherman, perhaps you may be interested in an aluminum sports boat.

For further information on these items or in the Aluminum News-Letter, write to the Aluminum Co. of America, Pittsburgh 19, Pa.

Weather Instruments

There are few water and sewage plants in the country that do not record data on the weather. Some actually act as official weather observatories for the climatological service of the U. S. Dept. of Agriculture. Those which are not supplied with this official equipment often find it necessary to obtain their own. No doubt the catalog titled **Weather Instruments,** issued by M. C. Stewart of Ashburnham, Mass., contains pictures and dia-

KNOWN AROUND THE WORLD AS THE SIGN OF EXCELLENCE IN WATER TREATMENT EQUIPMENT

MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

The years of experience behind the Roberts nameplate is your assurance that any water rectification problem is expertly handled to your best advantage. As manufacturing and installation engineers, the Roberts organization is equipped to meet your exact needs regardless of the size of the equipment or the complexity of the problem.

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grams of the equipment that you may want for your own weather observations. There are wind indicators that give direction and velocity; there are maximum and minimum thermometers of different types; and the catalog also includes barometers, rain gages, and an auto compass.

Write to M. C. Stewart, Ashburnham, Mass., for a copy of this catalog on Weather Instruments.

Vacations

The Metropolitan Life Insurance Co. of New York has just issued two reports titled **Vacations for Industrial Workers** and **Vacations for Office Workers.** These reports are designed to assist executives who are setting up new vacation plans or revising old plans. The reports point out the increasing tendency of employers to regard vacations as a reward for work faithfully performed in the past as well as a period of rest and recuperation for the work that lies ahead.

The reports cover such points as company policies, types of plans, provisions of plans, length of vacation service requirements, and methods of calculating both the vacation pay and the minimum work requirements during the preceding year. Also included are assignment of vacations to individuals, and methods of announcing vacation plans to employees.

Copies of these reports are available to managers of water and sewage works, as well as managers of industrial establishments who request them on their business stationery. Address: Policyholders Service Bureau, Metropolitan Life Insurance Co., 1 Madison Ave., New York 10, N. Y.

Pneumatic Ejector

In the November-December '46 issue of **The Yeomans Guard** there is a story on the Yeomans Type SS pneumatic ejector which is offered as a single unit for pumping screenings, sludge, scum, grease, and for metering.

This issue of The Yeomans Guard also contains a story on horizontal double suction design pumps which have been added to the company's line, and tips on repacking the stuffing box.

The Yeomans Guard may be obtained from Yeomans Brothers Co., Chicago 22, Ill.

Liquid Conditioning

A new handbook on the conditioning of water and other liquids has been issued by the Liquid Conditioning Corp. In this 60 page bulletin titled **Equipment and Materials for Conditioning Water and Other Liquids,** the company has described all of the many different types of water conditioning processes and explains the applications. advantages, and limitations of each type.

Included in the bulletin are tables listing the various kinds of gaseous and solid impurities, and showing the effects, limits of tolerance, methods of removal and residual amount of each impurity after treatment. Another chart shows the chemical results produced by various water treatment methods.

The book is amply illustrated with diagrams showing the principles of construction and operation of various processes and equipment for softening, clarification, and demineralizing of water and other liquids. The book also contains a series of tables of general data and conversion factors.

Catalog G may be obtained from the Liquid Conditioning Corp., 423 W. 126th St., New York 27, N. Y.

HOW TO
"KEEP OUT OF THE LANDSCAPING BUSINESS"
Here's
THE HOUSE
you've got to get your pipe-line to!
HAZARD #1
is a "jungle" of expensive landscaping... impossible to trench through.
HAZARD #2
is a paved, heavy traffic, street.
SOLUTION
... a HYDRAUGER will bore an open-hole for your pipe-line, under the street, under the expensive landscaping, and right into the basement of the house if you want. And that's how to keep out of the landscaping business!
HYDRAUGER
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SAN FRANCISCO, CALIFORNIA

5 GOOD REASONS
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... COUNT 'EM!
1. STRONG electroforged construction for easy erection.
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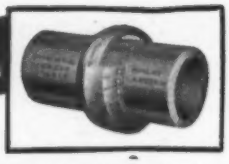
BLAW-KNOX ELECTROFORGED STEEL GRATING

WESTON



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The Perfected Method for Making Sewer Pipe Joints of Cement

- No jute used—gasket centers spigot.
- Definite space in each joint for cement.
- Form confines cement-grout to lower portion of joint.
- Particularly advantageous in water-bearing trenches.
- Infiltration minimized.

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822 E. 8th St. Erie, Pa.

Engineers and Sales Agents

Check Valve

Made in all sizes from 1 to 20 inches, the **Williams-Hager Flanged Silent Check Valve** is shown and described in a four page bulletin of that name, published by the Williams Gauge Co., Pittsburgh.

This bulletin features dimensional details and tabular forms and shows diagrammatic cross sections of the valves as well as installations.

The valve, which may be used in public utilities, refineries, chemical plants, pump lines of all kinds, is furnished with bodies of iron, semi-steel, cast steel, bronze, and other types of metals. According to the bulletin, this valve will operate in any position and it may be easily installed or removed for inspection.

A copy of the bulletin may be obtained by writing direct to The Williams Gauge Co., 3065 Pennsylvania Ave., Pittsburgh 12, Pa.

Handy Table

In a handy cardboard folder, the R. W. Sparling Co. of Los Angeles has issued a set of **Tables of Water Equivalents.** You can carry it in your pocket or open it up and place it under the glass on top of your desk. It will show you at a glance the relation of weight, power, and volume, the relations of rates of flow, and the velocity in different sizes of pipe.

This set of handy reference charts for converting water measurements in one set of terms to another may be obtained by writing R. W. Sparling, Box 3277, Terminal Annex, Los Angeles, Calif.

WANTED—ASSISTANT MANAGER

College graduate engineer with experience for position as Assistant Manager of a municipally owned water works system serving a population of 75,000. State age, qualifications, and experience. Salary $4,200 per year. Write care of Box R, Water & Sewage Works, 155 E. 44th St., New York (17), N. Y.

FOR SALE

2 Municipal Sanitary Service Corp. Clarifying Filters, Repulpers, Pulp Storage Tanks, and all appurtenances in excellent condition. Vacuum Type, Revolving Drum 8' dia. x 10' long. In place at Great Neck Village Sanitation Plant, Great Neck, L. I., N. Y. Immediate Delivery.

FOR SALE

One—1,000,000 Gallon Ground Storage Tank. 73 feet in diameter, 32 feet high. All-welded steel construction. Condition excellent. Built—1939. Department of Water and Sewers, City of Miami, Florida, P. O. Box 4821.

REPAIR and SAVE
Water Meter
Measuring Chambers
with the
MEMPHIS SLOT INSERT
of stainless steel with new bronze thrust roller.
For further information and free ⅝" samples
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℞ for a headache!!

$Fe_2(SO_4)_3$ FERRI-FLOC

Apply to affected water in small doses. Relief should be immediate.

Free information and samples can be acquired from

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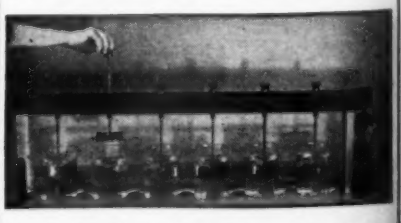
BOND-O
Sulphur Joint Compound

Our BETTER BLENDING means that each batch of BOND-O comes out of our machines exactly compounded and thoroughly mixed. Cast iron pipe joints made with BOND-O show this difference. Less initial leakage from every joint made.

NORTHROP & COMPANY, INC.
50 CHURCH STREET
NEW YORK 7, N. Y.

THE *Phipps & Bird*
LABORATORY MIXER . . .



IS the important piece of equipment in the Modern Water Works Laboratory. Now being used by leaders in water works research. Many superintendents and chemists have been able to reduce their chemical costs by the control of chemical dosages with this mixer. Write for literature.

PHIPPS & BIRD, INC. Richmond, Va.

Pipe in American Life

The Committee on Steel Pipe Research of the American Iron and Steel Institute has prepared a 48 page illustrated booklet on **Pipe in American Life** to present the historical background and modern uses of metal pipe, with emphasis on the use of steel pipe. Chapters are devoted to uses of steel pipe in homes, buildings, industries, railroads, shipping, mining, and in water supply systems, as well as oil, gas and refrigeration industries, and irrigation on farms.

Copies are available without charge from the American Iron and Steel Institute, 350 Fifth Ave., New York 1, N. Y.

Anaerobic Corrosion of Iron in Soil

In September 1941 the American Gas Association instituted a Research Fellowship on iron corrosion at the Agricultural Experiment Station in Rutgers University. This project was completed in July 1945 and the final report on the fellowship, which was held by R. L. Starkey and K. M. Wight, has been recently published under the title of **Anaerobic Corrosion of Iron in Soil.**

Although this work was done in specific reference to iron and steel pipe used for carrying gas and with particular consideration to the soil redox potential as an indicator of corrosiveness, the whole report is of considerable interest to both water and sewage works men.

It is of interest to water works men because cast iron pipe is also subject to corrosion in soil, just as are gas pipes, and it is of interest to sewage works operators because it deals with the microbiological anaerobic corrosion and the production of hydrogen sulfide, conditions which exist particularly in sludge digestion tanks.

The book, which contains 107 pages and 203 bibliographic references, discusses such things as characteristics of corroded iron and steel surfaces, origin of sulfide, characteristics of bacteria causing anaerobic corrosion, the importance of sulfate reduction, the mechanism of the process of microbiological anaerobic iron corrosion, the utilization of hydrogen and reduction of sulfate by bacteria, etc.

The authors are respectively Robert L. Starkey, Professor of Microbiology and Research Specialist in Microbiology, and Kent M. Wight, American Gas Association Research Fellow, Department of Microbiology, both at the Agricultural Experiment Station, Rutgers University, New Brunswick, N. J.

This book may be obtained from the American Gas Association, 420 Lexington Ave., New York 17, N. Y.

Cathodic Protection

In a small folder the Trimount Instrument Co. of Chicago has presented the story of **How Cathodic Protection Prevents Rust in Elevated Water Tanks and in Deep Well Pumps.** Shown in the folder is a cathodic rectifier unit made by the company, as well as a diagram of how to install the unit for these purposes.

This little folder, Bulletin No. 142, and further information may be obtained from Trimount Instrument Co., 37 W. Van Buren St., Chicago 5, Ill.

Water Conditioning Manual

If you are a power plant operator and want to know how to take care of testing equipment, obtain samples, or carry out analytical test procedure, what you want is the new 12 page instruction booklet entitled **Allis-Chalmers Water Conditioning Chemicals and Equipment.** Come to think of it, if you are in the water business at all, you may find this booklet of considerable interest.

One section is devoted to the importance of feedwater control, another to the handling of apparatus, and a third to collecting samples, a fourth to reporting results, and the fifth to test procedure. If you don't do your work yourself, the bulletin also lists the costs of various services, and if you want equipment and chemicals, there is a price list of these as well.

We suggest you write to Allis-Chalmers Mfg. Co., Milwaukee 1, Wis., for a copy of Bulletin 28X6385.

ZECO
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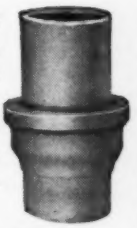

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DORRCO DOINGS IN 1946

1946, the first full year of nominal peace, has been one of readjustment. It started with high hopes of that great peace production the world so badly needed. The pressure groups brought set-back after set-back until production was shot; and the Nation rebelled and gave what many feel is a mandate for a free Democracy again.

If the termination of the coal strike, as this is written, proves another sign that the pendulum is starting a long swing back from the rule of special privilege, it may be worth what it has cost the public this year in man-days lost by labor troubles.

Internationally much progress has been made; and those listening to the United Nations debate have felt a world education in Human Relations was taking place, which was not so apparent from the headlines.

* * *

GOLD—A broad resurgance in the gold industry has been noted. The most notable instance is a Canadian mill which is doubling capacity to more than 4000 tons per day, thus becoming runner-up to the great Hollinger for top, gold-producing honors in Canada. Our contribution to this expansion—18 tray thickeners, 20 agitators, 3 classifiers and 18 sludge pumps.

In the Philippines, a large order from Benguet Consolidated highlights renewed activity there. In Mexico and Central America, increased silver prices have acted as a spur to gold as well.

PULP AND PAPER—This year we supplied eight new continuous recausticizing systems for pulp mills with an aggregate daily capacity of 2500 tons and are modernizing old systems at four other plants. A number of installations have been made, too, for producing satisfactory process water from impure sources.

Two rather unusual installations have been made for black ash treatment. In one, black ash is to be leached and washed continuously for soda recovery prior to recausticizing. In the other, the carbon residue is to be washed, after acid treatment, preparatory to activation.

SAND—Many new classifiers indicate the trend towards well-washed, high-specification sand. Three 250 ft. dia. thickeners, in a single long basin, will recover wash water for re-use in West Virginia and will be the largest thickener installation in the East.

CEMENT—Renewed activity everywhere is evident. Four new American plants have adopted our closed-circuit grinding system on the raw end with at least two more to follow. Additional systems are being supplied to cement makers in China, Colombia, Chile and Panama.

CHEMICALS AND PLANT ENGINEERING—The large number of brine purification jobs reflects the continued heavy demand for chlorine and caustic soda. Largest clariflocculator to date is a 125 ft. unit in Texas, to treat upwards of 2000 gals. per min.

Testing and plant engineering hit an all-time peak. Three types of projects predominated: the treatment of nickel ores by the Caron process for South America and the East Indies; alumina projects for the United States, Russia and Australia; and chemical fertilizer plants for this country and England.

SUGAR—Enforced lack of maintenance during the war has made modernization a keynote this year. Cane sugar has shown an unprecedented demand for continuous juice clarifiers and vacuum mud filters. New cane varieties have created new clarification problems. This year we built the largest clarifier in our history

Most of the tonnage of beet sugar in the United States is made by our Continuous Carbonation System, several new units of which went in this year. Our Rapid-Cooling, Rotary, Lafeuille Crystallizer is giving many times the capacity of conventional batch units.

DE-IONIZATION AND FLUOSOLIDS—Our D-I System, in addition to its use for complete de-ionization of water and edible syrups, is being used for the removal of impurities from sugar-bearing solutions and for recovering a valuable syrup from a fruit processing waste.

FluoSolids investigations continue with gratifying results. We are now working on its application to limestone, precipitated lime sludges and various metallurgical operations.

SANITATION—The Sanitary District of Chicago has reaffirmed its faith in our clarifiers by contracting for 24 additional 126 ft. units for the West-Southwest Plant which will bring the nominal capacity to 700 million gallons per day—by far the largest in the world. The City of Baltimore is converting 18 of its 30 acres of trickling filters to high-rate units by the addition of 30 of our distributors—the largest such installation in this country. The Cities of Savannah, Georgia; Dallas, Texas; and Long Beach, California are typical of other large cities which we have served this year.

In Puerto Rico we are supplying equipment and erection supervision for 10 new sewage plants and for the new water treatment plant of the City of San Juan. At Jackson, Michigan, extensive field tests are demonstrating conclusively the economy and efficiency of the shallow-bed, trickling filters, which we have advocated, as compared with deep-bed types.

ABROAD—Our associated companies, especially in England, are going strong and the Continent is coming back fast. With the necessary equipment or services supplied either from Europe or America, we have been active in Europe, Asia, South America and Africa—largely in petroleum, sewage, potash, paper, cement, coal, copper and gold.

* * *

The industrial unrest and unbalanced production have given us great problems to meet. Like many others in both consumer and durable goods industries, we shall end this year with greatly enlarged unfilled orders due to the lack of labor, material and shipping facilities for export.

A month in Germany last Summer emphasized the problems faced there, and attendance at a quadripartite session brought home, as no words could, the difficulties of international relations and the great efforts being made by all to solve them. The almost infinite patience needed, I believe, is there.

Members of our staff, who have been scattered in Europe, Asia and South America this year, are united in feeling much progress is being made. To our friends and to the Dorr staff everywhere, we send New Year's greetings with the belief that the year 1947 will see a crystallization of the efforts that have been made and a clearer course charted for a United World.

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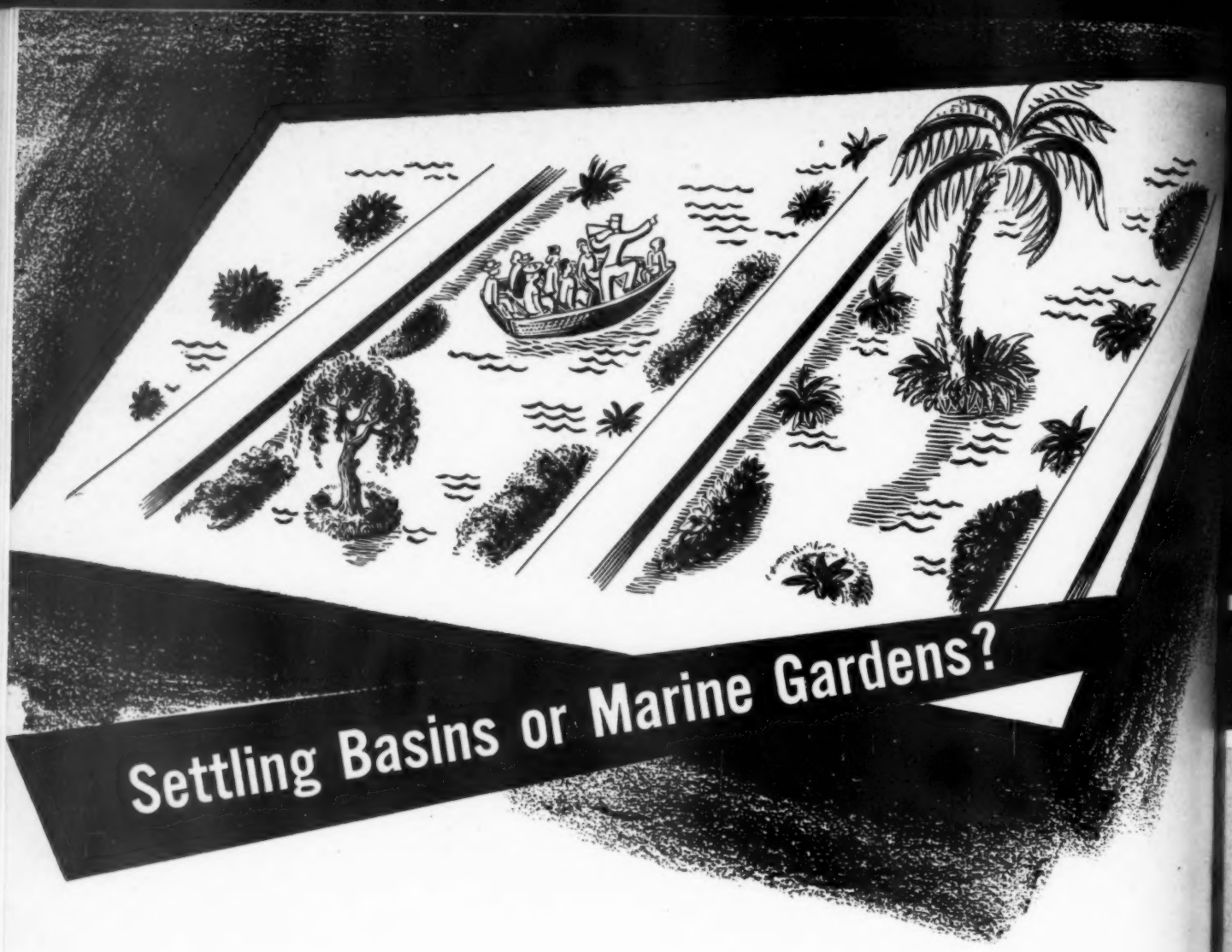

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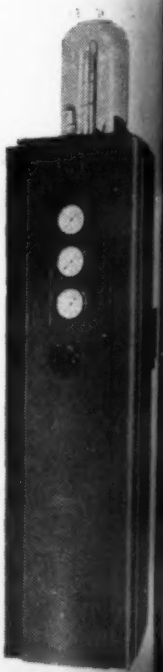

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